NAGALAND EMPOWERMENT of PEOPLE through ECONOMIC DEVELOPMENT (NEPED)

NEPED

PROJECT TITLE:

STRENGTHENING NATURAL RESOURCE MANAGEMENT AND FARMERS' LIVELIHOODS IN NAGALAND

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TITLE PAGE

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CONTENTS

Acronyms

AEA	: American Evaluation Association
APMC	: Agricultural Marketing Produce Committee
DAO	: District Agricultural Officer
DHO	: District Horticultural Officer
DSCO	: District Soil Conservation Officer
DSU	: District Support Unit
GoN	: Government of Nagaland
HoDs	: Head of Departments
ICEF	: India Canada Environment Facility
ICIMOD	: International Centre for Integrated Mountain Development
IDMAT-ASEED	: International Institute of Development Management Technology of Asian Society for Entrepreneurship Education and Development
IDRC	: International Development Research Centre
LEAD	: Leadership on Environment and Development
NEPED	: Nagaland Empowerment of People through Economic Development
NIP	: Nagaland Industrial Product
PA	: Participatory Approach
POU	: Project Operations Unit
PRA	: Participatory Rural Analysis/Appraisal
SARS	: State Agriculture Research Station
SHG	: Self-Help Group
TERI	: Tata Energy Research Institute
TL	: Team Leader
VC	: Village Council
VDB	: Village Development Board
VM	: Village Marketing Committee

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STRENGTHENING NATURAL RESOURCE MANAGEMENT AND FARMERS' LIVELIHOODS IN NAGALAND

SYNTHESIS

The premise of the Nagaland Empowerment of People through Economic Development (NEPED) is on the fact that strengthening the livelihood options of the farmers in Nagaland would lead to sustainable landuse and result in reduction of land degradation and deforestation. The main donor of NEPED project, the India-Canada Environment Facility, has its own mandate for improvement of the environment. The farmers have their concern for the livelihoods that are sometime not environmental friendly. The aspirations of the farmers for better living conditions, availing modern health services and providing good education to the children had necessitated the farming household to generate cash income to meet these aspirations. In order to fulfill the donor's mandate and farmers' aspirations, the NEPED project embarked on a mission to bring about a transition from subsistence agriculture to market oriented strategy in the mindset of the people by cultivating shade tolerant crops beneath the growing trees that were planted during the NEPED phase – I period from 1995 to 2000.

The main project fund received from ICEF during the period 2001 to 2005 was used to induce the required transition. The NEPED team was the agent of change for the farming community in Nagaland to cause a transition from: dependent mindset to an independent one, traditional agricultural practice to an improved livelihood production systems and subsistent agriculture to a vibrant rural economy. The IDRC supported in meeting the need to fit the bill, by providing resources for the action research and studies into; 1) the village agricultural practices on intervention in extending the cropping phase as compared to traditional one, 2) the existing marketing system prevailing in the village, 3) understanding the agricultural products that have demand in the market, 4) identifying crops that fits the bill and bring out a list of 'menu crops' and its production practices, 5) studying the potentials of pole marketing, 6) market intelligence and value addition needs, and 7) building the capacity of farmers and project personnel in the required areas of operations.

The adoptive management strategies employed by the farmers to changes occurring in their lives were found to be impressive. In the jhum system, with rising needs for generating cash income for the family, the farmer had put more areas under crops that have demand in the market reducing the areas put under the crops that are used for household consumption only. The increased area put under annual crops like ginger, French beans, rice beans, Soya bean, Turmeric and Taro were observed directly by the researcher and was confirmed by farmers through interviews and discussions. It was also observed that areas under perennial and plantation crops like large cardamom, pas sion fruits, black pepper, banana, oranges had increased. While farmers had increased areas under marketable crops they were also making effort, mainly by the women, to preserve the traditional crops thus maintaining the crop germplasm.

The change in the jhum landscape presents a contradicting scenario. There is a decrease in areas put under jhum in the southern district of Mokokchung, Wokha and Zunheboto and these areas are now getting converted to secondary forest and in some cases moving towards climax forest. The change could be attributed to interventions by projects and market forces. On the other hand, in the northern districts of Tuensang, Kiphere, Longleng and Mon, the area put under jhum is increasing or constant unlike its counterparts in the southern districts. This is because there is less opportunities for market intervention due to remoteness of its location from market centres resulting in prohibitive transportation cost.

Identification of 'menu crop' and linking them to market was a major challenge addressed by the programme. The criteria we set for the 'menu crop' were: it has to be shade tolerant so that trees are preserved, it has to be of low volume and high value so that farmers are able to 'carry

a fortune on a head load' and the crop has to have a high demand in the market. The next challenge was to collect the small surpluses individual farmers had produced so as to form a critical mass to attract buyers. To address this, the Government constituted Village Marketing Board (VMC) which was utilised in marketing of Passion fruit in some villages in the district of Wokha and Mokokchung. The VMC members became the facilitators and the conduit between Government department staff and farmers in relaying information from Government offices to farmers such as the time and place of collection of products where transaction took place.

High price expectation for the product the farmer had produced was another problem that the project team had addressed. The project also conducted study tours of farmers and Marketing Board members to the processing sites. We also facilitated in analysing the cost of processing with farmers and factory management staff. The conclusion the farmers and factory management arrived at was that in order to keep one of the reasons that led to the Government of Nagaland in notifying to the farmers to subsidise transportation cost.

Starting with the early 1990s, tree plantation in Nagaland became a movement. This movement was accelerated by NEPED-I with the funding received through IDRC, Delhi from 1995 to 2000 because the message of the benefit of tree plantation in jhum was spread to 857 villages across Nagaland. Many of the Test Plots that were planted with trees in 1995 to 2000 were cut down and brought under jhum cultivation and poles were used for either firewood or others. By making an inventory of these poles in 21 sites, the project team members were able to quantify the main stand parameters growing in one hectare of jhum land. We estimated that the average number tree species was 52 ranging from as low as 17 species to as high as 115, the average number of standing poles was 872, volume was 188.37m^3 and basal area was 14.77m^2. It was observed from this study that in those villages where tree plantation was done in jhum the number of trees per hectare was more than 600 as compared to those that were not planted were only about 200 even though the cropping period was two years in both the cases. An important finding was that, in jhum plots where the cropping period is only one year, the number of trees was about 2800 in 8 years fallow land. On the other hand the number of trees was only about 400 trees in the plot where the area was subjected to cultivation for four consecutive years with 24 years fallow period.

In this study it was also learnt that in those villages where the farmers had planted firewood species such as Oak species, the owners were able to sell them at good price and earned income for the family. The lesson about the benefit of planting trees along with jhum was shared in different fora; like the academics, with farmers, decision makers and colleagues, by the project team members.

Post Project Evaluation was conducted internally by the project team in 2007. This was done with an objective to understand the sustainability in the continuity of project activities initiated during NEPED – II project period (2001 to 2005). NEPED – II was winded up in July 2006. The project was establishing rural micro credit mechanism in the villages, it was important that a continuous monitoring is in place even when the project is not financially supported. It was felt necessary that a post project evaluation of the project villages was undertaken by the project officers to find out which of the villages were doing well and which are not. It was also felt necessary to identify the gaps in case of those villages that were not doing well and strengthen those that were doing well by giving technical support.

NEPED – III came into operation with a set of five new members replacing with only five former members still in place. Exposing the new members to the NEPED-II project was going to be beneficial as capacity building process for them

RESEARCH PROBLEM

The major challenge facing Nagaland now is how to adapt its land use pattern and productive systems to the increased population pressure and changing life-style, making them biologically and economically sustainable, while also compatible with local cultural aspirations. Shifting cultivation, sustainable under low population density, is no longer viable. Fallow periods, once twenty to thirty years, have now fallen to five to eight years or less in many areas. Fragmentation of farmlands through inheritance of ancestral properties by members of the family has resulted from an almost self-sufficient in food, to produce enough for just eight to nine months and must rely on off-farm employment to make up the deficit. Notably, jhum cultivation is a way of life for the Nagas, and is deeply rooted in Naga culture, customs and beliefs. Any development interventions must work within the culture and ethos of Naga society. Hence, the need is to attain food security through intensifying production within the jhum cycle, as well as to provide alternative sources of income through diversification of crop, livestock and forest production.

As a result of increased population pressure on land and changing life-style, there are increasing numbers of migrant workers to the urban for wage earning and many families are permanently settled in the cities even under uncertainty of getting the next job. As the fallow period decreased, the fertility of the soil is decreased and soil erosion is impacting on agricultural productivity and increasing the rate and amount of land degradation. In addition, forests are increasingly being exploited for generation of cash income and to meet the demand for wood in the lowlands. This is done indiscriminately, resulting in local drinking water shortages and the degradation of rich forests, in an area among the highest in biological density in the country.

Nagaland Environment Protection and Economic Development (NEPED – I 1995 to 2000) had addressed these issues building on the concept of agro-forestry in jhum fields. In order to meet increasing demands for timber which were leading to forest degradation while simultaneously addressing problems of erosion, the project supported the plantation of tree crops in the jhum system. This concept attributes its success in part to the traditional mixed cropping system of jhum; the activities simply focused on adding one more 'tree crop'. The agroforestry system also engaged a longer term vision of planting selected shade-loving cash crops among the trees. These crops can yield income during the fallow period, which is also the gestation period of the trees. Trees may then be harvested for timber and other wood products as the land is cleared to begin the jhum cycle again. By adopting proper crop rotation and combination of trees and other crops, jhum cultivation can be a key component of economic development in Nagaland.

Extensive consultation with farmers, village leaders, NGOs and government officials in Nagaland indicates that the first phase of NEPED successfully focused on small farmers who are now adopting tree plantation in their jhum fields on a wide-scale and the capacity to sustain this appears well established. However, there arose a need to move beyond this first stage and assist the Naga farmers in managing, harvesting and marketing of tree products; improving the cultivation of shade loving cash crops in the fallow period; improve marketing and economic returns through better institutional and market linkages and value-addition; and to continue to identify strategies to intensify the grain production of jhum systems. For example, beginning in 2001, some villages had returned to land areas committed to tree plantation in 1995 and later. By 2005, most villages which planted trees will be scheduled to return to land with tree plantation from NEPED I. Without intervention many farmers in these villages will likely be forced to choose from two options: (1) utilise the tree plantations sub-optimally by harvesting all immature trees and reverting to jhum cultivation; or (2) bring new land into production by encroaching on accessible primary forests to meet their family food and income needs. This project supported VDBs to develop improved and sustainable income-generating options for land already utilised for agriculture and tree production, thereby supporting improved

management of land, forest, soil and water resources.

As such, programme to improve cultivation techniques and soil management methods, add cash-generating fallow management crops and develop local-based processing and marketing options were urgently needed. The NEPED II project provided income generating marketing and value addition options to the village communities by providing key inputs to Naga farmers to incorporate cash generating crops into their traditional agricultural cycle. The integration of fallow crops into the cropping pattern of the agricultural system of the Nagas will provide for more sustainable utilisation of natural resources on the one hand, and generate surplus cash to improve their livelihoods on the other.

It may be noted here that the programme 'Strengthening Natural Resource Management and Farmers' Livelihoods in Nagaland' supported by IRDC, New Delhi was to start simultaneously with the NEPED-II project in 2001. The idea being that the research results would serve as the precursor to actual implementation in the project sites and villages. However, this could not be done because of the funding procedural delays. In order to get the research fund from the donor by NEPED, the following procedural steps were required (See Annexure-II)

Only after the above 13 steps are fulfilled, funds could be utilised for undertaking the activities under the programme. The project was designed to start the work by the 1st week of April 2001, but actual receipt of the 1st Instalment was possible only in December 2002. The subsequent instalments also passed through the same procedure.

As a procedural delay in receiving funds from the donors, several precursor works such as case study of 'Naga Loan', discussion with village authorities, supply-demand study for crop selection became redundant. In view of this, the unspent amount was used in activities that the project considered to be appropriate and one of them was Post Project Evaluation studies in lieu of 'Naga Loan'.

CHAPTER- I

RESEARCH FINDINGS

I. Sustainable Systems for Extension of the Cropping Phase in Jhum

The implementation of this activity was done in two different structures. One was implemented by the Project Operations Unit (POU) members of NEPED where replication of the Model developed by State Agriculture Research Station (SARS) was tried out in 8 districts and the other was Off – farm and On – station research were conducted by a team of researchers from SARS, Yisemyong to improve and also find solutions to the problems identified by farmers in its replications.

1. Experiences of upscaling the SARS model in eight District

1.1 Background

On-farm trials were initiated by the NEPED research team in Mokokchung. In traditional practice, rice was grown as the main crop during the first two years of the jhum cycle, followed by fallow (of seven to twenty years). In the trials, farmers were asked in the third year to select one cover crop from three options: rice bean, velvet and soybean. These crops are traditionally grown in jhum fields as secondary crops. Initial studies have shown that the cover crops improve soil fertility due to biomass addition and nitrogen fixation. Hence, the land productivity is increased and the farmer can cultivate rice or another cereal crop in the fourth year, thereby obtaining additional income. Notably, the seeds of cover crops are consumed as pulses and the leaves are used as fodder and as green manure; hence, the cover crops integrate well within the Naga farming system.

In Nagaland the jhum farmers normally take 2-year cropping with rice as the major crop. After this cropping period the field enters the fallow period in the third years. In order to increase the cropping period, researchers from State Agriculture Research Station (SARS), Yisemyong (Mokokchung district) developed and tried out a model. The farmers took the normal crops for two consecutive years and in the third year legume cover crop namely Velvet beans was introduced in the same field. This cover crop cultivated area was followed by sowing of rice in the fourth year. According to SARS team report, the harvest of rice in the fourth year after the cover crop was 2.1 MT/ha as compared to 2.0 MT in the second year. This trial was replicated with some farmers in the villages of Mokokchung district and was found to be adoptable by selected farmers of those villages. Should this model be acceptable to the farmers of Nagaland in large scale the implication on the length of fallow is tremendous because the period shall be twice the present practice.

While this approach was tested in small numbers in the district of Mokokchung in Nagaland, further on-farm testing of these practices was carried out in eight other sites across Nagaland involving 5 to 8 farmers' fields.

Study (Methodology at Annexure-3) showed that in Nagaland the average carrying capacity under the present form of jhum system was only 80 pers/km². This average was estimated in five northern districts that were mainly depending on jhum cultivation for subsistence. With the increasing population pressure on land, if the present trend of land supporting only 80 pers/km² continues, the system would collapse resulting in the emergence of complex problems of supporting livelihood practices in the rural villages. In order to prevent this, the SARS model was designed and tried out which, when succeeded, would increase the carrying capacity of jhum to 142 pers/km² (Table 2, system 3 of Annexure) although it met with only limited success. Fortunately, in many of the communities, the farmers were already innovating and practicing improved jhum system that had increased the carrying capacity of jhum beyond 80 pers/km², some of them are discussed below.

1.2 Objective

To identify and test sustainable cropping systems and patterns that enables an extension of the cropping phase thereby intensifying the jhum system

1.3 Methodology and Implementation

In order to upscale the model in other districts, the Project Operation Unit (POU) members of NEPED project made an attempt to replicate them in 8 villages of 8 districts (Mon, Tuensang, Mokokchung, Zunheboto, Wokha, Kohima, Dimapur and Phek) of Nagaland. The villages were selected after a survey was conducted and identified the locations where by traditional practise, the field was to enter fallow period the following year.

The introduction of the cover crop with legume was done in the third year after a detailed consultation with the farmers who had agreed to test the model. The criteria of selection were:

- willingness of the 3 to 5 farming families to take part in the field test on their own farm,
- nearness to the main road that could serve as demonstration plot, and,
- the field had been cultivated and is to enter fallow the following year.

Having selected the site along with the farmers, the project provided the farmers with legume crop seeds for sowing in the site. The most common seeds were velvet beans, rice beans, Soya beans and French beans. Depending on the suitability of the site conditions and availability of seeds, farmers were encouraged to choose their seeds. In many cases when velvet was the chosen seed for the test, they had to depend on outside source for the seed because velvet bean was not a traditional crop for many villages of Nagaland.

Technical supervisions were provided to the farmers on close spacing. This was particularly important so that the field is well covered by the legume crop and weeds are suppressed. In Wokha jhum plot, the quantity of top soil erosion taking place in that field was measured. As the legume crop matured farmers harvested the crop sown by them. After harvest the field was prepared for sowing rice, which was done and harvested in the fourth year.

The experiment was completed in the villages of Sakraba of Phek district, Wokha village of Wokha district, Settsu of Mokokchung district, Leangknger of Tuensang district, Nsunyu village of Kohima district, Pherima of Dimapur district and Khetoi village of Phek district. One common major problem faced by the farmers in these test sites was that the labour inputs for weeding was very high and the other faced by the site in Zunheboto was that cattle were let loose for free grazing by the village council in the site where the test was been conducted. As a result the area needed to be fenced and that escalated the cost of test way too high to the tune of incurring an amount of Rs.43,875.00. The implication was that the model could work only if supported and therefore not sustainable.

1.4 Case study on quantitative soil erosion measures:

In order to compare the soil loss, a trial plot and control plot measuring (30ft x 10 ft) each was demarcated and two units using polythene sheets were installed at the bottom of the field. It was important to note that trial plot and control plot are located at the same elevation and degree of slope, aspect and adjacent to each other. The boundaries are heaped with soil in order to control soil flow from outside. At the bottom soil is dug out with size 10ft length, 1.3ft depth and 1.3ft width and covered with plastic sheet in a sunken manner. Both the edges are dipped inside the earth so that the eroded soil is properly trapped. The soil collected in the plastics at the bottom was shade dried and weights taken for comparison. This exercise was taken at regular intervals during rainy season. This was installed only in 1st week of May, 2002 and started collecting the soil data. It was observed that soil erosion is very significant in both the plots, but it is more in trial plot.

In all the villages where the model was tried out, the farmers were enthusiastic about sowing legume crop in their jhum fields although they were apprehensive about the model as a whole. This led to the conclusion that farmers were knowledgeable about the benefits of how legumes can add nutrient to the soil and the market demand of some legumes especially Soya bean, Rice bean and French beans. They are willing to cultivate them to generate cash income for the family by selling the surplus product. This led to incorporating more cultivation of legumes in rural poverty alleviation programme both in NEPED and other Government aided projects. In fact the trials had contributed to the Government of Nagaland in realization that French beans could be one major crop that could be cultivated in commercial scale in the villages and thus address the strengthening of livelihoods in the eastern districts of Nagaland.
In traditional practice, rice was grown as the main crop during the first two years of the jhum cycle, followed by fallow (of seven to twenty years). In the trials, farmers were asked in the third year to select one cover crop from three options: rice bean, velvet and soybean.

Table 1. Model for extension of cropping phase beyond normal 2-year period

Year-1	Year-2	Year -3	Year -4
Rice	Rice	Legume cover crop	Rice

1.5 Farmers' evaluation

The project team solicited the perception of the farmers on the on-farm trials of the model to extending farmers consider it a risk to undertake this model as a practice and hesitate to incorporate them into their jhum system. The evaluation of the farmers were summarised as follows:

- There is shortage of labourers to cultivate 3 fields in a year: the current jhum, the second year jhum and the extended cropping phase that was introduced as intervention. They require financial support to maintain additional plots
- Weed control is more difficult than normal cultivation. In the third year plot, the weed proliferation is much higher than that of the two normal jhum plots; as a result farmers had to put more labour in tending to weeds of the third year plot.
- Farmers faced soil borne Grub infestation, which was affecting the paddy plants, and in the long run, affected the yield.
- Velvet-bean was recommended as the cover crop in the third year to replenish the soil that had been exhausted during the previous two cropping years. However, as there is no market demand for Velvet -bean, farmers had difficulty in disposing of their product because this crop is not a traditional food item for the farming family.
- Farmers observed that formation of nodules is more in local varieties of rice bean than that of Velvet-bean. Moreover, rice bean has demand in the market, so wherever local site factors were feasible for the cultivation of rice bean, farmers cultivated the rice bean.
- Paddy yield was higher in the fourth year, wherever they have sown cover crops in the 3rd year
- In the location where Velvet bean areas had done well, the paddy plants die due to very loose soil structure. But in case of other beans especially Soya beans, the soils are left compact for which paddy crop is growing better.

Table.2: Soil loss collection from 10 May to 27 Sept 2002 at Wokha in an area of 30ft X 20 ft

Experiment plot	Trial plot where 3rd year cultivation took place	Control plot where farmer left to 1st year fallow
Soil accumulation in kgs	20.5	14

From the above Table.2 it is visible that subjecting an area to cultivation in the third year had

resulted in accelerated soil erosion as compared to erosion taking place in the fallow land. This soil erosion in the third year could be the reason why prolific weeds establishment in the field leading to added workload for farmers. This result also indicates that the Model need to be carried simultaneously with soil erosion control measures being put in place.

Conclusion and recommendations

It was observed that the model will work under the following conditions:

- In the villages where the jhum cycle is below 4-year fallow period due to acute population pressure on jhum land
- When all villagers agree and participate. This is important because by tradition there is a collective action in the maintenance of footpath to the jhum site, which in some cases is as long 8 km away from the village, therefore it would be too much work for only a handful of farming adopting the model. Wild animals, especially birds feed on the crops grown by the farmers. When all farming families are cultivating in the same location the animals could feed on a large area of jhum land where the destruction may not be significant. On the other hand when only a handful of family is jhumming in an area at a good distance from the village, the crop is damaged by wild animals. Because of these reasons and more, the collective action of all villagers is required.
- Payment of compensation for additional workload to the farmers in maintaining the 3rd and 4th jhum plots is given till such time the farmers incorporate the model into their jhum system. It was observed that the participating farmers continue to maintain their normal practice of having the first and second year jhum plots. Thus the farmers end up cultivating four number of jhum plots that put too much pressure to the farming family.
- Sufficient quantity of quality legume seeds is made available on time. It was seen that the farming families usually keep only a limited quantity of seeds that they know it to be sufficient for the next jhum cycle. In order to launch a programme of this nature, seeds need to be provided from outside source or, the preparation is done in the year prior to launching of the programme so that farmers are advised to put more areas under legume crop so that seeds are made available in the subsequent year when the programme is launched.
- There should be a number of variety of legume seeds that are suited to different climatic site conditions
- The legume crop must have a demand in the market so that the product is sold without difficulty
- In those places where only few farmers are adopting the model, cattle fencing materials were required to be provided to the farmers. During the normal cropping period the village community imposes social fencing where cattle are made to graze at locations far away from the cultivation site, once the crops are harvested, the cattle are allowed to graze freely all over the area. First year fallow land where the plants parts are tender and easily accessible, are the favourite place of cattle. Thus there is a need to provide fencing material if the programme is to succeed.
- Being a new practice, constant technical inputs by the technical persons is necessary
- Soil erosion control measure must be put in place because erosion is higher in the cultivated site is more than that of the fallow site as seen in Table.2
- Subjecting one particular site to third year cultivation is likely to inhibit naturally

regenerating tree seed sprouts. Therefore, tree plantation should be done along with cultivation in the first year; otherwise the field is likely to be barren of trees.

Drawing lessons from the above experiences it is safe to conclude that up-scaling the model should be done with caution. The experience was intimated to the Department of Agriculture, Nagaland. The Department had incorporated this model in their normal programme but with caution that it was to be implemented only in those villages where there is an acute pressure of population on land and the fallow period had gone down to as low as 4 years.

2. Documentation of Local Communities Practising Improved Jhum System

Review of stories and experiences among other systems as well as documenting the practices of local innovators who are already extending the cropping phase was done as case studies. This information guided the on-farm trials of possible options in experimentation of different crop rotations and intercropping options. Seven case studies were done in the villages Increasing population, changing limited land availability in some villages had compelled the farmers to extend the cropping phase beyond the normal period. The farmers were able to do this by relay cropping, agroforestry, crop mix, weed management and other ingenious methods that only the farmers of that locality could innovate.

Objective:

A comprehensive literature search at the Commonwealth Agriculture Bureaux International (CABI) in 1991 on shifting cultivation and related subjects had resulted in about 5 500 publications. Many of these publications arrived at the same conclusion as that of Nye and Greenland in 1960 in which the authors documented the results of measurements of the nutrient cycle during the cropping period as well as dynamics of the fallow period (Robinson & McKean, 1991)[1]. Despite these repositories of knowledge, researchers continue to conduct experiments and farmers continue to practice traditional systems of jhum cultivation. Many of these results when translated to farmers fields had only a limited success and worked as long as assisted. The hedgerow experiment in the district of Mokokchung during the late 1990s sponsored by GB Pant Institute, Itanagar, that failed to upscale, was an example.

Many farmers in Nagaland are innovators and little has been done to systematically document and recognize their creative experimentation, lessons learned and success stories. It was observed that farmers were able to adopt the technology when these success stories practised by a community were disseminated to other communities. Therefore, the need arose to document these practices and disseminate.

The objectives of this exercise were:

- documentation of practices of local innovative farmers extending the cropping phase, and

- disseminating the practise to other communities for adoption.

Review of stories and experiences among other systems as well as documenting the practices of local innovators who are already extending the cropping phase was done as case studies. This information guided the on-farm trials of possible options in experimentation of different crop rotations and intercropping options. Seven case studies were done in seven villages across Nagaland in order to find out the options for replication.

2.1 Extension of cropping phase through crop intercropping with legumes in Leangkunger village

[1] Robinson, D.M. and McKean, S.J. (eds), 1991. Shifting Cultivation and Alternatives - An Annotated Bibliography, 1972-1989. CAB International in association with CIAT.

Leangkunger is a small village in Tuensang district and lies in the far east of the district under the sub-division of Shamator administrative town. It is 56 kms away from the district headquarter. The village lies at the altitude of 1350 msl facing east. The cultivation area lies between the altitudes of 700 – 1450 msl which falls under the mid altitude with warm climate. Tuensang district has major crops like paddy, maize, Jobstear, millets, varieties of pulse crops and tuber crops. The district is far from self-sufficiency in production of food grains. Local production meets only 60% of the requirement. The district has less potential in terrace rice cultivation and maximum areas are under the jhumland where life depends on shifting cultivation system.

In Leangkunger village, jhum fields are cultivated for 4-5 years in the same site and are left to fallow for 7-10 years to regain its fertility before the next jhum cycle comes. The indigenous fallow management system is that in the first year once the crop is harvested in Oct-Nov, the field is rested for a short period till it is cleared again in February of the next year for the cultivation second year crops like millet, maize, French bean and rice bean. After the second year crop is harvested, farmers having sufficient would leave the site to enter into fallow phase but many farmers will continue to cultivate the same plot of land for third and fourth year by cultivating French bench, soybean & rice bean as a crop rotation. The yields are reported to be constant. Some go even for fifth year also in the same site.

Observations

- The most significant observation of jhum cultivation system in leangkunger village is the farmer's knowledge of soil fertility management.
- Cropping of leguminous crops like French bean (Kholar) and Soyabean compensate the possible nutrient losses during different jhum years.
- Preservation of nitrogen fixing trees like Alder spp. (Alnus nepalensis) and Albizzia sp. are maintained in their jhum fields.
- Yields are reported to be constant even if they grow for 4-5 years jhuming in the same piece of land.
- They know what crop to grow under what type of soils.
- Paddy does well in second year when deep hoeing in light and loose soils.
- Farmers believed that maize corn taste sweeter in the red soils than in any other types of soils. This may be due to more moisture in the red clay soils.

The farmers were aware that a short fallow period from Oct-Nov to Feb-Mar is essential before the next crop is cultivated, in order to recuperate the loss nutrient. They are also aware that legume crops such as French beans restore soil fertility and that its cultivation is essential for the plot of land that would be subjected to continuous cultivation. They are taking advantage of the benefit Alder tree that fixes atmospheric nitrogen.

2.2. Extension of cropping phase through soil management in Lazami village

Lazami is the biggest village in the district of Zunheboto having 700 households with a population of about 5000. Each household has an average of 7-8 family members the tribe called Sema pre-dominantly inhabits the District. Slash and burn system of agriculture is the main occupation for majority of the population of the district. The Village is situated at hilltop, which stands at an altitude of 1220 meters MSL (4026 feet). Study area as well as the general cultivation area consists of sloppy to very steep terrain.

Shifting cultivation system of Lazami village has been chosen as "case study for Documentation" for the reason that it practices two system of jhum:

The villagers It follows normal practice of slash and burn and cultivate the land for one or two years with paddy and different types of other crops and left the land fallow for a period of 8-12 years to allow soil to recuperate its fertility for the next jhum and

In the local context, system II of jhum practice has gone into record of sustained cultivation up

to nine years in the same plot of land without any yield loss on paddy. To cultivate a particular plot of land for several years is determined by deep and firm soil of clay loam with abundance of thatch, grasses, reeds and scanty number of trees.

Farmers reported that yield is better where the field is dominated by thatch and reeds. Continuous cultivation with assured yield said to have attributed to thatch cover. Paddy yield from such field are also reported to be heavier and tastier as compared to system ljhum. Good yield from thatch dominated field was also supported by agriculture scientist from the Department of Agriculture, Nagaland. It is said that the roots of thatch derives nutrients deep below and releases them to the root zone that helps paddy to absorb readily available nutrient. Soil in the thatch dominated area are also firm that helps paddy to establish its roots firmly in the soil hence no lodging problem.

In this form of shifting cultivation, the area of cultivation in the village is not localized after first year of cultivation. This is so because the number of year is not specified and depends upon the individual family concerned.

Here, jungle clearance begins by August to September and burning takes place by November. The reason for early clearing of jungle is to suppress weeds by chopping them off before they reach the stage of dispersing seeds. Other reason is, to allow the cleared jungles to get decomposed by absorbing retreating monsoon which takes place usually by October. This practice allows the cleared jungles and weeds to decomposed and add humus to the soil. The field is then set fire by November.

Calendar of activities of System II

Month	Aug-Sept	Oct.	Nov	Dec-Mar	Apr-May	Jun-Aug	Sep-Jan
Activities	Slash	Collection of fuel wood	Field set on fire	Field cleaning, hoeing, Contour bunding	Sowing of Paddy and other crops	Weeding 3-4 times	Harvest of paddy and other crops

Right after the field is burned stumps are collected into heaps and burned again. This is followed by hoeing of field and digging out roots of trees and lumps of grasses and burned. These stumps and lumps are also used for contour bun to control soil erosions. Contour bunding is an important operation of shifting cultivation for conservation of soil fertility, said an elderly member during the study. Contour bunding is practiced by using locally available poles, stumps and boulder across the slops at an interval of 10 to 15 feet. An interesting aspect on this practice reveals that, using poles and stumps of plants as bearers to control soil erosion gets decomposed after three years of cultivation. These bearers are then hoed and mixed with soil which then become manure added to soil for further cultivation. This practice also reveals that after the third year of cultivation, further bunding is enforced for soil erosion measures by planting specific crops along the contour such as yam, ginger, maize and tuber crops.

It is also interesting to observe that addition of food crops other than paddy in the shifting cultivation has sequence of scientific findings as part of soil fertility conservation measures. One aspect is farmers planting crops such as yam, ginger maize just above the bunds as enforcement to soil erosion control measures. While immediately below the contour structure, planting of leguminous crops like Soya bean and cow pea is an important practice. This tradition could be the reason of sustaining the cultivation for such a long continues cultivation at a particular plot for several years. Other aspect on weed management is, farmers have very intimate knowledge on specific obnoxious weeds. Obnoxious weeds are those weeds that are difficult to eradicate and hamper in weeding operations such as weeds that can regenerate

through seed as well as by vegetative. Such weeds also produce roots at each node that make difficult to control. On this count, farmers uproot these weeds, stock them in bags and throw them far away from the field so that the seeds are not easily dispersed to the field. They also remove these weeds and put them on stones and boulders so they are roasted by the sun.

During the month of August and September just before harvest, farmers meticulously pick the flower buds of weeds, stack them in bags and throw them away beyond the boundary of the field. This practice prevents further spread of weeds in the following years. Easy decomposable weeds are uprooted and dumped below the soil which then add humus to the soil

There are several critical stages of field operations. However, at the beginning of field cleaning and digging out the stumps of thatch and reeds are very difficult operations while, weeding time during June and July is the most crucial period for the success of shifting cultivation.

'Shifting Cultivation System practiced by us is a sign of prosperity' declared a participant in the village during this Case study. The reasons he gave goes like the yields are always assured, and they can grow all that are required for their family consumption in a year which includes rice and vegetables. This practice is also closely interwoven with their culture and traditions
He also goes on to say that " once one of our villagers got land leased to him by our neighbouring village Kashanyu (Rengma village)". My village fellow knew that the land is fertile so he continued tilling the field making good harvest each year till the ninth year. It was only when the land owner came back to the plot for his second shifting cultivation and seeing his tenant still cultivating he went back home shocked.

Concluding remarks

The study showed that through careful management of soil it is possible that the cropping phase could be extended without reduction in the yield of rice. However, the study also concluded that as the year of cropping increased there is also a tendency for proportionate increase in weeds. To mitigate the weed problem deep plough is given and the root of obnoxious weeds especially those of thatch were exposed and eradicated. These results were disseminated to villages where thatch was passing as a problem for cultivation.

Slash and burn and continuous cultivation in the same plot of land with different varieties of paddy and other crops for several years with its own uniqueness of weed and soil management practices. After cultivating for 5-6 years (maximum record is 9 years) the field, is left fallow for at least 15-16 years and the cycle is continued. After the second year cropping weed population explosion takes place.

The study showed that through careful management of soil it is possible that the cropping phase could be extended without reduction in the yield of rice. However, the study also concluded that as the year of cropping increased there is also a tendency for proportionate increase in weeds. To mitigate the weed problem deep plough is given and the root of obnoxious weeds especially those of thatch were exposed and eradicated. These results were disseminated to villages where thatch was passing as a problem for cultivation. The time to leave the field for fallow is indicated by decline in yield and severe infestation of weed. This system of cultivation is very popular in this village.
The result of this study was disseminated to project villages. This was particularly useful in those villages where the farmers had shown interest in the cultivation of vegetables and development of Homestead gardens for permanent agriculture.

2.3 The transition from jhum to sedentary agriculture through relay cropping in Pfutsero

Given an opportunity farmers are capable of transforming the hitherto jhum fields to a permanent agriculture. This is possible when they have the prospect to earn income through conversion of the jhum fields to sedentary agriculture and the site condition is suitable for such condition. Farmers are also aware that soil nutrient should be replenished so that they are able

to continuously cultivate the same plot over the years. An example of such practice was observed at Pfutsero in the district of Phek, Nagaland.

About forty years ago a large chunk of primary forest was logged for timber by the community who owned the land and this was followed by subjecting it to shifting cultivation. The farmers cultivated the crops that they would normally grow in jhum; maize, beans, millets, jobs tear, Pyrilla, ginger, yam etc. The farmers also cultivated potato and cabbage along with the jhum crops. They found out that they could sell potato and cabbages at a good price and also have a high demand in the market. Thus the farmers converted this shifting cultivation area into a sedentary agriculture.

The farmers knew that in order to cultivate the area year after year without fallowing they have to retain the soil fertility. The farmers practise different soil conservation measure, relay cropping, crop manipulation and also use weeds for mulching.

Management practices to retain and add nutrient in the soil

Summer crops are taken during April to September. The field is slashed close to the ground in the month of January and left to dry. By February and March a deep plough is given and dried vegetations are buried in the furrows. The main crops grown are Maize, French beans, Cabbages and Mustard leaves. Sowing of seed takes place in March and April and are harvested in September and October. Three times weeding is given mostly by hand. The weeded material are heaped on a rock or trees tumps and when they are sufficiently decomposed and farmers are sure that they will not sprout, then they are used as mulch.

By September the farmer harvested the standing crops that were sown in March and April. It was observed that farmers gave a deep plough and all crop residues including the stalks were buried in the furrow. The line of the plough is normally just below or above the line where they had harvested the summer crop.

Concluding remarks

It was observed that the farmers of Pfutsero were able to transform their jhum fields to sedentary agriculture through utilising weeded material as mulch, burying harvested crop residues of the previous season instead of burning them, constructing contour bunds with stones and other hardy materials prevent soil erosion, importing and applying farm yard manure and Intercropping with legumes such as field peas and beans that fixes atmospheric nitrogen to the soil.

In addition to the above management practices the farmers take advantage of felled trees by retaining tree stumps to decompose in situ, this process adds humus to the soil. Farmers informed that the decomposition of roots of these tree stumps continues for an over 15 to 20 years and adds nutrient to the soil. Planting trees which shed leaves such as Alder and deciduous trees at regular intervals, add nutrient to the soil.

2.4 Alder Based jhum of Khonoma

The inhabitants of Khonoma practise a cropping system that has a distinct feature. The people grow and manage Alder (Alnus nepalensis as a means of improved cropping and fallow systems. Alder Swidden fields in Khonoma have been developed over generations, creating a wide variation in individual tree age within the alder stand. Most alder-based jhum fields are terraced by placing logs across the slopes or with permanent rock walls

Young trees are pollarded for the first time at about 6-10 years old. Pollarding is done in December to January by cutting across the trunk at about 7-8 ft above the ground and fresh mud is applied on top to protect cut portion from desiccation. A stone is then place above the cut portion to protect the trees from frost damage and ensure coppices will sprout from the sides.

The people of Khonoma follow a cycle of cultivation where the management of alder trees follow a cyclic rotation of two years cropping and two years fallow. The fallow is reopened after two years.

Concluding remark

This Alder based system not only replenishes the soil fertility but also there is income generation for the family through selling of firewood. Several studies had been done on this system of agriculture. Prominent among the study is one done by Dr. M. Cairns, Department of Anthropology, Australian National University, Canberra on 'Fuel and Fertility: Alder's role in land use intensification' (LEAD & ICMOD Partnership – 7 July, 2004).

Disseminating this system of agriculture was done in almost all the NEPED project villages. Although Alder grows in an alleviation range between 1200 to 1700m, the farmers were able to correlate the concept to the trees that could be grown in their locality and have similar result. The often quoted species for this was *Schima wallichi* in some cases the farmers also in favour of Gamari (*Gmelina arborea*), which can be planted in mid alleviation, can be pollarded and is soil enriching. Farmers from different parts of the State were also taken to this village for exposure to the system.

2.5 Changes of Land Use Patterns in Nagaland : A case study of Sungratsü

The common changes in the land-use that the NEPED project team had come across are the conversion of traditional jhum areas into a permanent forest. Such a change has been observed in Mishilimi village of Zunheboto district, Mohung of Mon district, Süngratsü of Mokokchung district etc. In these villages, although a jhum location that was cultivated by all farming families has been converted to permanent forest, no pristine forest has been brought under cultivation as one would have imagined.

In order to understand this trend, a case study was undertaken by NEPED team members to see the enabling factors that brought the changes in the landuse in Süngratü village. In this village two jhum areas were changed to other form of land use. One location called *'Loyalo'* had been converted into Wildlife Reserve in 1998 and the other *'Lemchalu'* had been converted to 'Model Village' where the farmers are practicing sedentary agriculture. This 'Model Village' has enabled the sustainability of the Wildlife Reserve at Loyalo. The villagers admit that since there is no corridor adjoining the Reserve site the 'return' of animal is not dramatic although there are signs of increased population of higher vertebrates such as wild boar, deer etc.

Süngratü is located about 20 km northwest of Mokokchung, the district headquarter. The total population of the village is 4374 living in 470 households. The village leaders presume that there is more number of Süngratü villagers living outside the village than residing in the village. Most of them are living in Mokokchung, Kohima and Dimapur. The elders estimate that the total number of household in Süngratü village is over 1500. Most of these persons residing outside the village are employed by the State Government of Nagaland. The others are those who pursue off-farm activities in the form of business ventures, wage earnings and private entrepreneurs.

The radial elements contributing to the landuse changes in the village

With the market assured, the villagers began to plan forward to upscale the three radial elements resulting in the increased landuse changes within the village's boundaries, reconverting jhum land to forest. The major causes are cash crop production, pigs rearing and off-farm activity especially masonry that they are capable of achieving.

a. Cash crop production

Having understood the potentials that lie in generating income from cash crop, the village council resolved to set aside one jhum location colloquially known as *'Pok'* at *Lemchalu* permanently for its production. This *'Pok'* was called 'Model Village'. The villagers concentrated in the production of passion fruit, ginger and vegetable in this location.

Just when the area was being demarcated for the purpose of the production of cash crop, the NEPED project selected the village for implementation of the project unaware of such decisions being taken by the village authority. With the revolving fund placed at the disposal of the farmers, they were able to procure necessary planting materials and other accessories such as materials for trellis to cultivate passion fruit, seeds for vegetable production etc.

In 2004, with the assistance from the NEPED project they could produce 12 truckloads of passion fruit and was sold to the Longnak Fruit Factory @Rs.8/kg. The management from the factory came to the village and purchased them and so they were able to accurately count the number of truckloads of passion fruit that went out. The village authorities stated without hesitation "without NEPED this would not have happened".

The farmers were also able to purchase seed ginger and cultivated them. During 2004, the council made a resolution to prohibit selling of ginger outside the village so as to retain the seed for expansion of its cultivation. However, within the village a farmer could sell ginger @Rs.10/kg for seed purpose (at this point of time the rate in Dimapur ranged from Rs.15 to 25 per kg). The villagers informed that they had initiated the purchase of a ginger processing unit to be installed in the village.

Vegetable vending is also a major component of cash generating source for the village. The elders estimated that the daily in flow of cash from 20 to 25 women vegetable vendors is about Rs.500/day per vendor. Farm product like colocassia, chilli, tomato, cucumber, banana, mango, plum and leafy vegetables are the main items of vending. The gross income ranges from Rs.10000 to Rs.15000 per day.

The villagers also grow tea bushes at the backyard of their home. They prepare homemade tea which is organic and processed to the taste of the family. The surplus is also traded by the women vendors in Mokokchung town generating income for the family.

b. Increased backyard pig rearing

As a tradition, backyard pig rearing is a common practice in this village as in almost all villages of Nagaland. The rising demand for pork in the district headquarter Mokokchung and also the neighbouring villages had led Süngratü villagers to take a collective action in rearing pigs for sale.

For rearing of pigs in the backyard the limiting factor is the feed, although there is a high demand for pork in the market. The enabling factor for this collective action was the introduction of the white variety Tapioca and its widespread cultivation by the residents of the village. In the past, they were cultivating a reddish skin variety of Tapioca which they were not able use as feed for the pigs because the skin of this variety is poisonous for the pigs. In the recent past the villagers were introduced to a new variety of white skinned Tapioca that does not poison the pigs. With this new variety farmers were able to put in more areas under cultivation. As a result, almost all household began to rear pigs.

With the increase in the rearing of pigs by the residents of the village and resultant market linkages, the village council started to standardise the trading process. The regulations for standardisation, among others, are as follows:

a. Live pigs are to be sold @Rs.53/kg. The prevailing rate in the surrounding villages of Longpha, Longyong, Chomu, Mopungchukit and Impur is @Rs.55/kg. The reason is simply to attract traders from Mokokchung, the district headquarter
b. Pork is to be sold at Rs.70/kg while the prevailing rate in Mokokchung is Rs.75/kg
c. Selling rate of piglets for rearing was fixed at Rs.1000/piglet or Rs.90/kg.
d. Strict prohibition on bringing pork or piglets from outside the village

e. In order to maintain transparency, a Weighing Machine is installed at the centre of every Khel where traders could use them in trading the commodity.

The farmers of this village prefer rearing pigs to cultivating rice in jhum field because they could rear pigs for sale and buy rice instead of cultivating it in jhum. According to the Village Council Chairman, the sale-proceed from pig is estimated at Rs.8 to 9 lakhs in 2004.The bottom line is, as a farmer stated, "It is more beneficial to have a pig at the backyard than a granary".

c. Off-farm activity

As indicated before, out of over 1500 families from Süngratsü village, only 470 families are residing in the village. Over 1000 households are living outside the village and many of them holding key positions in the Government of Nagaland set-up where the fellow villagers could either get employment or avail Government contracts where they could make a living and also prosper. The land being privately owned is thus left uncultivated and turned into forest.

Many of Süngratü villagers are good masons. They learnt the trade by doing the work at the village because stones are available in large quantity in easily accessible locations such as the road and levelled sites. Travellers and traders having noticed their workmanship, employ them in the construction work. Many of these masons have turned professional and have given up traditional farming. Much of their time is spent in wage earning in other villages and towns. It is learned that their expertise in masonry works is recognised and utilised in as far as Mon, the northernmost district of Nagaland.

Concluding remark

There are three radial elements that propelled the village the transition: cash crop production, increased backyard pig rearing and availability of off-farm activity opportunities that are triggered by trading of Anyüshi had enabled Süngratü village to change their landscape.

Süngratü villagers were able to identify their core zone in Anyüshi and were able to build on the tradition of producing high quality. By increasing the production and maintaining a high quality of Anyüshi, they were able to attract traders from other villages and thus increase the sale. Through this core element they were able to popularise other radial elements like passion fruit, ginger cultivation and piggery. Through this process of trading the product of the village, they were able to change the landuse from shifting cultivation to other forms of livelihood options. While there are opportunities available for trading the agricultural based product, they also strengthened the intrinsic traditional expertise of the stone masonry works and exported its workers. These masons went to earn wage to as far as the northernmost district of Mon and brought home cash for circulation within the village.

The transition from shifting cultivation to cash economy had enabled Süngratü village to dramatically reduce areas put under jhum cultivation that resulted in increase of the forested area. Thus, they were able to set aside a large chunk of their hitherto jhum land into Wildlife Reserve at *'Lechumlo'.*

The concern raised in many fora had been that due to rapid increase in population, primary forest areas are being brought into shifting cultivation, while this may have occurred in some villages; there are also many villages where the forest areas are increasing similar to Süngratü village. In the course of extensive tour across Nagaland, the POU members had asked, local elderly persons who are well above 50 years of age, if in their memory, primary forest had been slashed and brought under shifting cultivation, we are yet to find one who would give affirmative answer. All of them had given negative answers to our query.

The issue now is that area under primary forest is not being brought to jhum cultivation; it is a fact that there is a dramatic increase in the population that has a resultant pressure on land. Therefore, there is a need for systematic study into the adoptive strategies employed by the

farmers under the circumstances, explore the possibilities of improving the jhum system and sustain the system.

2.6 The Konyak Jhum System and Its Management Strategies

Panoramic view of the landscape in Mon district has three distinct features. Firstly, there are scanty primary forests. Secondly, expanse of current jhum that is taking place is breathtaking. Thirdly, the natural regeneration of secondary forest as the jhum locations enters fallow period is impressive. In fact, even a trained agronomist if he is an outsider may be deceived into considering these fallow areas to be a secondary succession forests and not shifting cultivation area. How the farmers have been able to develop this system of fallow management processes is a question one would continue to ask.

In many villages of Mon district rice produced from shifting cultivation is sufficient for 4 to 6 months only. Yet farmers, in Mon district have developed strategies to meet those deficit months with confidence by manipulating the crop physiology and incorporating them into the cropping system. The extent of indigenous knowledge they possess on wild food for collection in times of need is remarkable.

The document seeks to have a closer look at how the farmers are able to innovate and develop systems to meet the challenges.

The case study site, Ngangching village was selected as a random selection and not for particular speciality. The Konyak jhum system as to how the farmers deal with trees as a 'crop' and nurse them for the next jhum cycle, in itself is special.

The Konyak Jhum System is significantly different from other jhums of Nagaland. There are three outstanding differences primarily on the following features with jhum practitioners of other communities.

2.6.1 Management of trees in individual jhum plots

- A conscious effort made to preserve naturally sprouting tree seedling in the jhum individual jhum plots. As a result of these efforts one can observe that there jhum plots are densely populated with tree pole dominantly with *Macaranga denticulata*
- Preservation of standing trees from the previous jhum cycles are a common sight, dominant species is *Schima wallichii*. The farmers lop the branches and leave only the top, thus the standing trees does not shade the standing crops.

2.6.2 Crop manipulation and crop mix resulting in the extension of cropping phase to the third year

- Unlike other tribes of Nagaland, the Konyaks have two staple food; rice and colocasia. Therefore, farmers cultivate rice along with *Colocasia* in the same jhum plot. Rice is a light demander crop whereas Colocasia is broad leaved crop, which in assumption would shade rice. Thus mix cropping of these two seems unlikely combination, yet Konyak farmers have been cultivating them as a normal cropping practice.
- Another feature is that they cultivate cassava in the contours and field boundaries that are harvested in the third year. Thus the cropping phase is extended

2.6.3 Islands of forests in jhum cultivation areas

(1) Forest gardens at the outskirt surrounding the village. A forest garden is a garden modelled on a natural woodland (Patrick Whitefield,---). The term 'forest garden' is a translation of Konyak work *Pam ling. 'Pam'* means garden and *'Ling'* means forest. In 'Chokri' language of the Chakhesang tribe this landuse is called '*Sukha*' which means to say 'tree reserve'. Thus forest garden is a widespread practice through Nagaland.

Most Naga villages are perched on the top of a mountain. While establishing a village the

primary forest trees are felled for house construction and other uses. The forests in the immediate surroundings of the village are left intact. In course of time large trees of these forests may have been felled to meet the varied needs of the village to give chance to the growing stock to establish itself. Although large trees are not to be seen anymore, these forests are still to be seen as the remnants of the primary forests that once existed in the past.

The function of these forests is numerous. The farmers are able to collect wild vegetables for household consumption, dead wood for firewood, medicinal plants, poles and ropes for house construction, wild food in times of lean period and games for meat. One important function is also it serves as a place for relieving oneself since toilets are not available. It also keeps the village cool. The forest gardens relieve the pressure on the primary forests because had it not been there, all wild collections would have been done in the primary forests.

Farmers do enrichment planting in the open space with fruit trees, economic trees and other perennial plants to meet the household needs.

(2) *Livistona jenkinsiana* (Toko pat) garden: In villages of Mon district, more than 80% of the roofing materials are made from *Livistona jenkinsiana* (Toko Pat) leaves. As a result, *Livistona jenkinsiana* (Toko pat) gardens form part and parcel of the jhum system. The farmers, therefore, have established and preserved the gardens in the jhum plots. Some of the gardens are considered even more than 100 years old. The size of a garden is on an average, measures 40m X 40m. The number of trees in a plot is about 50 to 70.

The main function of the garden is to provide roofing material. Other subsidiary functions are: wild vegetable are collected beneath the canopy, fruits are a source of food during the lean period and are also sold for cash. Other ecological functions include soil conservation, moisture retention and serve as windbreak.

Other features about *Livistona jenkinsiana* are;

1. A house measuring a plinth area of about 25ft X 12ft require 40 to 50 bundles, each bundle containing 50 leaves. Thus about 2000 to 2500 leaves are used.
2. In one plant more than 10 new leaves sprout each year
3. Leaves from young plants are used only for construction of field hut and not for house construction
4. For house construction leaves are collected from trees which are more than 10 years old
5. When harvesting the leaves, at least three leaves are left behind on the tree
6. The prolific leave sprouting takes place during winter
7. The garden owner sells the leaves @Rs.2/leave in Mon Town. In the village the owner sells the leaves at a lump sum amount of Rs.500/- for roofing a house

(3) Remnants of primary forests at uncultivable sites: The uncultivable sites refer to those areas that are too steep for agriculture like ravines, rocky portion, and the simply left to serve as water sources. The immediate reply to a question as why these areas are not cultivated is that, they are too steep for cultivation. Further probing reveals that these areas perform the following function:

- They are the sources of poles and ropes requirement for house construction
- Wild vegetables are collected from these areas
- Bamboo shoots are collected from these sites in the month of October and November, just after harvest. Collection of bamboo shoots in other months is prohibited
- They serve as the catchments area for rainwater. Invariably perennial springs are observed at the lower reaches of jhum location where jhum cultivator fetches water to meet their requirement when working in the field.

- Often small games are attracted in these areas and farmers are able to trap or shoot for a meal
- Large trees in the area are mother trees for seed dispersal
- Sometimes timbers are extracted from these sites. Thus it generates cash income. Notwithstanding the immediate reasons given by farmers, they are aware of the fact that these remnant primary forests play a vital role in the jhum system.

Concluding remarks

Management of trees in individual jhum plots through selective weeding and preserving poles for the next jhum cycle is a practice of the Konyak community was a system that was promoted by the team members to other communities. The practice of crop manipulation and crop mix resulting in the extension of cropping phase to the third year at the same time retaining and managing the sprouting tree saplings need to be circulated across the jhum communities.

Maintaining islands of forests in jhum cultivation areas is known to be a good practice because it is a way of in-situ conservation the original biodiversity. As the surrounding jhum areas enter into fallow period the dispersal agents come into play and propagate the seeds and soon the field is restocked with the original species. Had this 'islands' not being present, the filled would have depended on pioneer species to fill the gaps created by slash and burn practice during the initial period of cultivation.

Forest gardens at the outskirts surrounding the village and preserved remnants of primary forests at uncultivable sites are the main sources of NTFPs for the villagers. From these forests the villagers are able to extract food, fibre and other necessary items that are required by a farming family.

Maintaining *Livistona jenkinsiana* (Toko pat) garden in the midst of jhum cultivation areas is a good example of sustainable utilisation of natural resources. The income generated from the sale of this leaf gives the owner the reason to conserve and maintain the surrounding environment intact, because they provide shade to the Toko pat.

2.7. Sakraba Villagers Developed Natural Resources Management Strategies

2.7.1 Cardamom cultivation and developing improved drier

Sakraba villagers of Phek district are excellent land resources managers. They have large areas of Alder firewood reserve forests surrounding the village. In 2001, NEPED project introduced rural micro-credit mechanism into the village. When the corpus fund was placed at their disposal by the NEPED project the villagers decided to use the fund for cultivation of large cardamom. As a result of this decision, villagers cultivated this crop in a large tract of the village forest. When they started to harvest the crop they were faced with the problem of drying cardamom capsule. Some ingenious farmers discussed this problem and designed a device to dry their cardamom and called it '*Sago*'. The capsules dried from this device was of superior quality that, in 2006 when the price of cardamom plummeted to Rs.45/kg in some markets of Nagaland, the Sakraba villagers were able to sell their product at Rs.92/kg and earned an income of Rs.70,000.00. They were able to sell the device to Government Departments of Nagaland.

The villagers, not only had earned income from the cardamom crop, they are also preserving the forest as shade trees.

2.7.2 Passion fruit cultivation

A group farmers from Sakraba village who were taken on study tour to Passion Processing Factory, Punanamai, a village in Manipur bordering Nagaland. The Factory has daily raw material consumption capacity of 2000MT per shift and is purchasing raw materials from surrounding villages and also from farmers of Phek and Kohima districts in Nagaland. In the same tour they saw the passion fruit farm of Süngratü village. Putting these two together, the

farmers of Sakraba decided to take a collective action in the cultivation of passion fruit in their own land. Now each of this 14 farmer had put in not less than 1 (one) acre of their landed area under passion fruit cultivation. This collective action of the 14 had set a trend of passion fruit farming in Sakraba village. Currently many more farmers from this village are putting in a lot more areas of land under passion fruit farming. A change in the landuse pattern is seen here in Sakraba.

The villagers had been increasing the area under its cultivation since then. In 2008 the farmers in the village had a gross turn over of Rs.223,000.00 from the sale of passion fruit alone.

Concluding remarks

According to village elders and leaders, Sakraba village now has four harvesting seasons instead of traditional one. The first harvest, Passion fruit, takes place from May to July, harvesting of Cardamom in October the second harvest followed by the traditional harvesting of rice and the last harvest takes place in the February and March, ginger crop.

While extension workers of the formal institutions are promoting double cropping and multiple cropping as one of the solutions to improve food security for the local community, the people in the villages are finding their own solution that suits their natural resources. The example of Sakraba in having four harvesting season was found to be more adoptable than going in for double cropping as promoted by the formal institutions.

Sakraba villagers of Phek district are excellent land resources managers. They have large areas of Alder firewood reserve forests surrounding the village. In 2001, NEPED project introduced rural micro-credit mechanism into the village. When the corpus fund was placed at their disposal by the NEPED project the villagers decided to use the fund for cultivation of large cardamom. As a result of this decision, villagers cultivated this crop in a large tract of the village forest. When they started to harvest the crop they were faced with the problem of drying cardamom capsule. Some ingenious farmers discussed this problem, designed a contraption to dry their cardamom, and called it '*Sago'*. The dried capsule from this device was of superior quality that, in 2006 when the price of cardamom plummeted to Rs.45/kg in some markets of Nagaland, the Sakraba villagers were able to sell their product at Rs.92/kg and earned an income of Rs.70,000.00. They are expecting a much larger quantity during 2007. They were able to sell the device to Government of Nagaland.

In the recent years it had been observed that these firewood forests in the eastern aspect had been planted with Cardamon underneath the standing trees. On the western aspect, the villagers had clear felled the trees and planted with Passion fruit.

3. Dissemination process of the findings to other communities

The findings became the talking points and provoking the thinking processes in the minds of the farmers. In several project villages, the farmers even moved the household and settled in the established homestead gardens and drastically reduced the areas put under jhum and that resulted in relieving the pressure on jhum land. This transition was observed in the villages of almost all the districts of Nagaland.

However, it was observed that development priorities of different sectors could have conflict of interests. While organisations such as NEPED had its priorities on protection of environment there are other agencies that had their main concerns in generating cash income for the communities at whatever the cost to the environment. On such case was observed in Oting village of Mon district. Through the initiatives of NEPED project, the farmers of this village started to settle down in their homestead gardens and much of their erstwhile jhum areas were been converted to secondary forest. In 2004 and 2005, a certain agency started to promote the cultivation of Jatropha and was able to convince the villagers to slash the generating secondary forest for its plantation.

In order to sustain the development of rural areas of Nagaland, a clear policy framework should be in place for the whole State so that farmers are kept in proper perspective and not be swayed by developmental agenda that come from time to time.

4. Results of Trials on Extension of Cropping Phase by State Agriculture Research Station (SARS), Yisemyong

Background:

Since time immemorial rice is grown as the main crop. In the olden days the productivity and the production of rice was very high, however, nowadays the yields have decreased drastically due to poor soil fertility. Hence, farmers crop for only two years and leave the field to fallow. Therefore, with a view to improve the soil fertility status through biomass addition and nitrogen fixation and to extend the cropping period up to 4th year, cover crop with leguminous crops like rice bean (dwarf variety), soybean etc were introduced in the 3rd year jhum fields. This system also helps in increasing the jhum cycle there by preserving the forest cover in the long run.

OBJECTIVES :

1. To intensify and extend cropping phase.
2. To improve the soil fertility
3. To cultivate paddy in the subsequent year.

MATERIALS AND METHODS

The trials were conducted after the harvest of paddy. Rice bean (dwarf variety) and soybean seeds were sown in the later part of June at a spacing of 50cm X 50cm plant – plant and row-row. Closer spacing was maintained to allow the cover crops for better ground coverage to suppress weeds and add biomass to the soil. The crops were raised without providing any support.

Results of the trials at various locations are described below.

1. Mokokchung Village

Jhum Intensification at Mokokchung village was taken up during the year 2006. Rice bean and soybean were used as cover crop. The crops were sown during the month of June – July. Soybean germinated well but did not do well. It exhibited thin and sickly growth which resulted in a very poor pod bearing whereas rice bean performed very well. The plant had a healthy growth and with a good foliage which covered the soil properly and suppressed weeds. Grains yield was also considerably good. Soil test report and grain yield of rice bean are given in table 1 and 2, respectively. Field day was also conducted in the month of December where 30 farmers participated. The crop was new to them and seeing its performance in the field they were very impressed and willing to take up in future.

Table 3: Soil Test Report.

Characters	Units	Rice bean	
		Before	After
PH	-	5.3	5.5
EC	-	0.3	0.3
OC	%	1.79	2.15
P2O5	Kg/ha	5.0	5.4
K2O	Kg/ha	130.6	156.8

Table 4: Yield parameters of rice bean and biomass.

Sl. No.	Parameters	Yield
1	No. of plants/sqm	8

Sl. No.	Parameters	Yield
2	No. of pods/plant	58
3	No. of grains/plant	84
4	Weight of grains/plant (gm)	43.3
5	Total grain yield/sqm. (gm)	346.4
6	Grain yield/ha (Q)	34.6
7	Weight of biomass/plant (gm)	146.6
8	Total biomass/sqm (kg)	1.17
9	Biomass/ha (Q)	117

2. Chare and Mopungchuket

Jhum Intensification at Chare (Tuensang) and Mopungchuket (Mokokchung) were taken up in the year 2005 and 2006, respectively, using soybean and rice bean as opted by the farmers with the objectives as the same reported in the earlier project documents.

Methodology:

a. Visited the villages and identified interested farmers.
b. Trainings imparted during April/May.
c. Seeds of soybean and rice bean distributed.
d. Sowing in the last week of June.
e. Intercultural operations during July/August.
f. Frequent field visits for supervision and observations were carried out.

Observations:

Chare: In Chare, rice bean seeds were sown but farmers had their own way in spite of the training imparted. Some farmers planted the cover crop in their abandoned 3rd year jhum fields while few farmers in their 1st year jhum with the intention to get better paddy yield from their 2nd year jhum field even though they understood the technology. Rice bean seeds germinated but the growth were not satisfactory. The crop showed stunted growth with less ground coverage. The trial was conducted for two consecutive years (2005-06). However, in both the years' performance of the crop was unsatisfactory. This may be due to inappropriate time of sowing or agro-climatic conditions.

Table 3: Soil test report

Characters	Units	Rice bean	
		Before	After
pH	-	5.4	5.5
EC	-	0.1	0.1
OC	%	1.30 (H)	1.50
P2O5	Kg/ha	11 (M)	14
K2O	Kg/ha	142.4 (M)	152.4

L=Low, M=Medium, H=High.

ISSUES TO BE TAKEN UP:

Optimum date of sowing for the crop needs to be determined under different agro-climatic zones. This will provide better research results for taking up the crop successfully in different locations.

Recommendation:

Rice bean is found to be unsuitable in relay cropping system. Therefore the crop should be used as a mono crop.

Mopungchuket: In this village both soybean and rice bean were sown in two different plots. The crops were sown during the month of June. Of the two crops, performance of rice bean was remarkable with good ground coverage and yield as compared to soybean.

The yield parameters of the crop and soil test report are given in table 4 and 5.

Table 4: Yield parameters of rice bean, soybean and biomass.

Sl. No.	Parameters	Yield	
		Rice bean	Soybean
1	No. of plants/sqm	8	8
2	No. of pods/plant	54	56
3	No. of grains/plant	81	168
4	Weight of grains/plant (gm)	43.1	11.52
5	Total grain yield/sqm. (gm)	344.8	92.0
6	Grain yield/ha (Q)	34.4	9.2
7	Weight of biomass/plant (gm)	150.5	52.4
8	Total biomass/sqm (kg)	1.20	0.419
9	Biomass/ha (Q)	120	41.9

Table 5: Soil Test report

Characters	Units	Rice bean	
		Before	After
PH	-	5.01	5.2
EC	-	0.3	0.3
OC	%	0.8	1.2
P2O5	Kg/ha	5.5	6.0
K2O	Kg/ha	125.97	175.3

3. Wokha district

The jhum cycle of the whole of Englan Range is only 4 – 5 years which results in very low productivity. The farmers usually cropped for only one year and leave the field to fallow. Hence, the research team identified this particular range and concentrated initially in Yikhum village for conducting the trial. The trial was started during the year 2004 with 10 farming families. With a view to get higher yield of paddy in the subsequent year, rice bean was sown right after the harvest of 1st year jhum paddy during the month of August. Seeds were sown at a spacing of 50 x 50 cm plant to plant and row to row. Timely monitoring of the work was done till harvest.

Table 6: Soil Test report.

Characters	Units	Rice bean	
		Before	After
PH	-	4.76	4.94
EC	-	0.1	0.1
OC	%	0.33 (L)	1.21 (H)
P2O5	Kg/ha	5.0 (L)	5.5 (L)
K2O	Kg/ha	224 (M)	250.8 (M)

L=Low, H=High, M=Medium

OBSERVATIONS:

Table 7 below shows that the yield of paddy in the 1st year was only 9 Q/ha which is much below the average yield. This low yield is mainly due to poor soil fertility status caused by short jhum cycle (3-4 years). Rice bean crop grown after paddy however, exhibited good grain yield (21 Q/ha) and also a good quantity of biomass (120 Q/ha) was added to the soil thereby enhancing the soil fertility status (soil test report before and after rice bean is presented in table

6. This improvement of soil fertility resulted in increased paddy yield from 9 to11 Q/ha (table 7).

Table 7: Yield of paddy, rice bean and biomass (Q/ha)

Crops / Years	Paddy	Rice bean (2nd crop)	
		Grains	Biomass
1st	9		
2nd	11	21	120

Rice bean crop showed significant growth. It was encouraging to note that the crops were very healthy in spite of delayed sowing giving good yield. Since the crops were planted closely, ground coverage was also good.

With the success of the trial and with timely training programmes and awareness campaign many farming families from other neighbouring villages has started to adopt the new technology.

4. On-Station

An on-station trial was conducted during the year 2006 after the harvest of 2nd year paddy to compare with the on farm trial results as well as to impart trainings and demonstrations to farmers. Field day comprising of 25 farmers was organized in the month of November to create awareness on benefits of growing rice bean in the 3rd year was imparted. Farmers were highly impressed on seeing the new technology. The crop was harvested during the month of December. The soil test, 1st & 2nd year paddy yield and 3rd year rice bean yield reports are presented in the tables 8, 9 and 10 respectively.

Table 8: Soil test report

Characters	Units	Rice bean	
		Before	After
PH	-	5.4	5.44
EC	-	0.3	0.3
OC	%	0.63	1.06
P2O5	Kg/ha	7.25	8.0
K2O	Kg/ha	243.06	247.5

Table 9: Yield of paddy (Q/ha)

Crops / Years	Paddy
1st	42.0
2nd	31.6
3rd	Cover crop (table 10)
4th	On going

Table 10: Yield of rice bean and biomass

Sl. No.	Parameters	Yield
1	No. of plants/sqm	15
2	No. of pods/plant	17
3	No. of grains/plant	22
4	Weight of grains/plant (gm)	11.5
5	Total grain yield/sqm. (gm)	172.5
6	Grain yield/ha (Q)	17.2
7	Weight of biomass/plant (gm)	150.1

8	Total biomass/sqm (kg)	1.65
9	Biomass/ha (Q)	165

CONCLUSION:

- The overall yield of rice bean in the trial plots was recorded to be low. The reason for the low yield is due to overcrowding of the crop which was planted at a closer spacing in order to have good ground coverage. However, low bean yield was compensated by high biomass addition fulfilling the objective of the project of rebuilding the soil.

In all the test plots there is significant improvement in the soil fertility status due to growing of cover crops in the 3rd year. The final result will be furnished only after completion of 4th year crop that will be taken up during 2007.

II. DEVELOPING AND EXTENDING IMPROVED APPROACHES TO MORE PRODUCTIVE MANAGEMENT OF JHUM FALLOWS

1. Background

Based on previous experiments and experiences of the farmers and information gathered from them and also experiences in other hill states in India and in the Hindukush-Himalayas, shade-tolerant crops have been identified as potential fallow crops including: large cardamon (Ammomom subalatum); turmeric (*Cucurma aromatica*); ginger (*Zingiber officinale*); betel vine; tree tomato; black pepper and passion fruit, were identified initially. Initial work done by SARS has found that farmers like the idea of introducing fallow crops, have gained additional income from these fairly easy to manage crops, and have observed better tree growth. The POU team gathered information about the market viability of these "menu crops" which helped informed discussions with farmers in their selection of crops for experimentation.

Farmers' interest in testing fallow management practices and introducing fallow crops were confirmed at village based meetings. The project team identified farmers in eight villages interested in participating in this study and work with them using PRA methodologies and semi-structured interviews to identify farmers' needs and preferred crops. Separate groups with women, men, and both sexes together were employed.

Information on the management practices of identified crops were collected through literature review and collection of primary experience in other parts of India on the management of these crops. The package and practices of spice crops on ginger, large cardamom, turmeric and chilli published by the Spice Board of India was of immmense help to both the farmers and project team members. Other states in India have extensive experience in the cultivation and management of some of the potential fallow management crops from which Nagaland can learn and draw. For example, in Sikkim there is massive cultivation of cardamon that reaches the India market and is very lucrative for farmers. While Sikkim is agroecologically similar to Nagaland and has a long experience in the cultivation of Cardamom, exposing Naga farmers to the farms in Sikkim was found to be fruitful.

As the case with extension of the cropping cycle, Naga innovators have already experimented with some practices of fallow management. Efforts were made to identify those farmers (both women and men) and build on their experimentation. Information about these farmers' practices was collected by POU members in up to 12 villages in each of the 8 districts. Existing information from SARS and POU team members were collated, and supplemented with information from key women and men farmers about these innovative practices, lessons learned and success stories.

2. Methodology for identifying fallow management crops

The common method of identifying the key crop for integration of fallow management crop followed the following steps

1. Walk in the farmers jhum fields, the village home gardens, orchards and other plantation crops that the villagers are producing either for sale or for household consumption
2. A village meeting is conducted consisting of both women and men farmers where they were asked to free list crops that, in their perception through experience have market demand with examples
3. Out of the free list the farmers were then asked to shortlist the crops by asking questions such as:
    i. Which of these crops is shade tolerant that could be grown along with the growing trees?
    ii. Would they have market demand in case the quantity of production is more than the local needs?

iii. Does the crop require constant technical supervision?
iv. What is the health of the crop in the village areas?
v. Is there a potential for the crop to be replicated widely in the village?
vi. Who could be the trader?
vii. Are the farmers familiar with the management practices?

4. Having asked those questions, the POU members compare them with the menu crops prepared in the NEPED in consultation with the SARS findings. It was observed in most cases the choice of crops was unanimous.

   The advantage of this process of choosing the crop was that,

   - the farmers have the knowledge in the cultivation of the crop so that the need for the technical supervision was minimised (there are no field assistant in the NEPED)
   - planting materials were already available in the village, or the farmers knew where they can procure them, thus the exercise the vigour of importing was often not required except when superior quality planting material was desired such as importing Varlangi variety Cardamom from Sikkim
   - Involving both women and men farmers in the discussion for identifying the crop was useful because a gender balanced view was arrived at.

     It was observed that the male farmers' choices were sometimes swayed by informed opinion. The male farmers were the target of trainings imparted by different agencies in the promotion of new crops, where they form opinions that it was the most suitable crop for the family. The women farmers who are tilling the farm most of the time had other choices that they consider the most practical.
   - The farmers own the choice of the crop and thus assume the responsibility to have a successful plantation in their field and do not look for a scapegoat in case of failure of the crop. They became more responsible from the selection of the planting to harvesting and marketing of the crop. They were also vigilant in finding the market channel

5. Criteria for selection of the demonstration plot were also discussed with farmers and the village council. Three to five farming families who were interested to take up this venture were identified by the village council in consultation with the POU members. These farmers had their land adjacent to each other so that a contiguous area of not less than 3ha. Was put under the demonstration plot. All the plots were either on the roadside or near the road so that it was approachable on all season whereby it served as centre for training and demonstration. The plots had been planted with trees roughly during first phase period of NEPED because it was to demonstrate the compatibility of cultivating cash crop along with growing trees. The crops selected for cultivation were all perennial and shade tolerant and that had market demand.

3. Off-farm testing of cultivation fallow management practice crops

POU and SARS team members identified farming families according to the criteria such as innovativeness, economic security, reliability, interest, available labour. Eight villages were identified with farming families who were willing to participate in the trial. In addition, SARS worked with at least fifteen farmers in each of the three districts of Mokokchung, Tuensang and Mon.

Crops implemented in the trials were selected by farmers in conjunction with POU and SARS staff based on information about management practices, market viability and farmer preferences. Appropriate varieties for best growing conditions in Nagaland were selected, also with an aim of meeting market demands for preferred varieties. Technical support through trainings was given to farmers in the cultivation and management of selected crops and tree species. In the test plots from the first phase, substantial thinning was carried out to allow for appropriate shade levels for selected fallow crops. Detailed measurements of yield, soil fertility, problems in production were taken in Wokha village.

As and when required, SARS and POU teams worked together to evaluate crop management and performance. Farmer participatory monitoring and evaluation was the key component in this area of work. Summary of the off-farm testing in the districts are given below:

3.1 Phek District

The following cash crops were planted under existing standing trees where the dominant species is Alder (*Alnus nepalensis*). 25000 Suckers of Cardamom were planted of which 3000 Suckers of Barlangay variety (Cardamom). There are about 2500 standing trees of Alder. Underneath these Alder the Cardamom suckers were planted alongwith 500 Saplings of Tree Tomato and 400 passion fruit saplings .As part of Research and Demonstration, to test whether Cardamom will grow well under Tree Tomato shade, an experiment was undertaken by planting Tree Tomatoes between Cardamom plants. The idea behind being that Cardamom has a gestation period of not less than two years to start generating income. During the gestation period, the farmers require annual income for their subsistence. Tree tomato bears fruit in the first year of planting and also has a demand in the market that would generate income for the farmer in the first year itself. An advantage of planting an annual crop is also that as the farming family gives management operations to the annual the perennial cash crop, in this case cardamom, automatically gets tended.

This trial proved very successful, as tree tomatoes are broad leafed, and do not shed leaves profusely during winter. Farmers also had dual benefit of production and sale of both Cardamom and Tree Tomatoes.

The survival rate of Cardamom is about 90%. The maintenance of the plot is also good and weeding activity undertaken regularly. During 2003, the farmers could harvest 650kgs of cardamom capsules, and about 150 tree tomato plants started to bear fruits. The fresh cardamom capsules were sold locally at Pfutsero @ Rs.10/kg, and the tree tomato fruits were also sold at Pfutsero. During 2004, a total of 1250 kgs of cardamom was harvested and the total number of fruiting plant of tree tomato was 345. The farmers harvested the fruits and sold in Pfutsero earning a substantial income.

Farmers' views:

- "This is a good system of farming which should be replicated in other villages, as it is not destructive to the forest, rather, we can earn a lot"
- "Toiling in paddy cultivation is very time consuming, but less paying"
- Many farmers expressed their desire for NEPED' assistance in establishing similar farms in their village.

The demo Agro-forestry farm in this village has played host to many farmers from neighbouring villages, who wanted to know more about this system of farming. On three occasions, the POU member and the DSU members organized trainings and study trips for farmers which included farmers of other villages. It is encouraging to see some replicates of this model in neighbouring villages not covered by the project.

Concluding remark

It was concluded that short term and annual crops need to be incorporated into the first and second year of planting perennial cash crop. The reason being that perennial cash crops such as cardamom, black pepper, betel vine, passion fruit and fruit trees require not less than two years before they start to bear fruit and generate income for the farmers. One of the advantages was also that farmers are able to tend to the perennial crop while generating income during the gestation period before they start to over shade the annual crops.
Learning example from this demonstration, farmers had started to cultivate annual crops in between rows of cardamom and passion fruit fields during the first and second year of planting, in Pholami village and neighbouring villages.

3.2 Mokokchung District

In Mokokchung district agroforestry demonstration plot was established in two villages with two different farming families. One of the plots was located in Longsemdang village involving a farming family. The family had planted Gamari covering 20 hectares in 1994-95 on the way to Mangkolemba. He had completed plantation of all cash crops in his farm. He is a progressive farmer who is interested in farming, and capable of extension of other crops. The farm area is good for demonstration to other farming families for the nearby villages.

He was encouraged to plant Black pepper and Passion fruit. During 2001, the planting materials was arranged locally and he has planted 5000 black pepper vines and 2000 passion fruit saplings respectively, during the month of June and July. However, the mortality rate of black pepper was high due to over age of the vines. He did gap filling during the subsequent planting season.

The second farmer had cut the primary forest in 2001, and started Passion fruit and Arecanut plantation. Passion fruit has started fruiting from the second year. The farmer has developed the passion fruit plantation on his own.

Concluding remarks

It may be concluded that short term and annual crops need to be incorporated into the first and second year of planting perennial cash crop. The reason being that perennial cash crops such as cardamom, black pepper, betel vine, passion fruit and fruit trees require not less than two years before they start to bear fruit and generate income for the farmers. One of the advantages was also that farmers are able to tend to the perennial crop while generating income during the gestation period before they start to over shade the annual crops.

Learning example from this demonstration, farmers had started to cultivate annual crops in between rows of cardamom and passion fruit fields during the first and second year of planting, in Pholami village and neighbouring villages.

3.3 Wokha District

The family members of Mr. Yankhumo Erui and Mr. Penry Lotha undertook the trial. The combined area of this demo plot is 3.5ha. These two farmers are very progressive, practical, and innovative and have concern for fellow farmers. They have history of being demonstrators who practice doable activities. The altitude at which they planted the demo crops is at 1350m above mean sea level. The general orientation is North-Eastern which is feasible for agroforestry crops viz. cardamom, passion fruits.

The main objectives of the demo was to showcase management of young growing trees while cultivating shade tolerant crops and generate additional income from shade loving crops till trees are harvested. The other objective is to study compatibility of shade tolerant crops under different tree species.

The shade trees were Alder which is a fast growing tree species and newly planted in 1999. Alder is good as fuel wood and coppices well. The planting material locally available, it adds humus to soil and is compatible with crops cultivated. In adjacent areas Alder trees are growing naturally and thus when the demonstration is successful, the adjoining field owners would naturally follow suit.

3.3.1 Year wise land-use of the demo plot was as follows:

I yr (1999): Cultivated Potato as main crop. The owners had a bumper harvest of potato (5MT) from 1 ha area. A single fruit weighing 1.8 Kg made an agriculture record in the state.

II yr (2000): Paddy was cultivated as the main crop. The harvest was very good. In the meant ime NEPED intervened and encouraged farmers to plant cardamom and passion fruits saplings. Few vegetables viz. solanum, colocasia, squash, chilli and sugarcane were also incorporated for domestic use.

III yr (2001): The farmers themselves desired to try out paddy again as the main crop in the same unit of land. But it was due to over shade produced by young Alder trees (10ft height); the yield of paddy was drastically reduced. It was reported that the farmers had a harvest of 16 tins from 4 tins paddy seed sown. Barbed-wire and some durable wooden posts were provided as trellis for passion fruits.

IV yr (2002): Another new area of 2 ha (approx) adjacent to plot is being slashed as extension. The local tree species were all felled retaining only Alder trees which were 13 years old. Atleast 2 truckloads of firewood had been collected during thinning process of the Alder plantation. The field was burnt and cleaned for planting cash crop viz. cardamom. The owners themselves arranged the planting materials locally.

The project supported erection of bally-posts to support trellis of Barbed-wire in 2001 for passion fruit. The in 2002 the passion fruit started to generate income for the farmers they were able to disposed 1 MT of passion fruit to Factory, Dimapur for quality testing by the APMC.

20,000 cardamom suckers planted in 2002, cardamom started bearing fruits in 2nd year. The growth is very encouraging. The number of tillers was 30-40 per hill with the height of 7-9 feet.

The farmers also tried wild local variety and it attained height of 12-14ft with heavy bearing of capsules. The size is more than double the size of the normal one with better taste. It is light green is colour.

In the second demo plot of Agroforestry, another technical session was held in which NEPED officials (POU& D SU) explained about the different methods of cultivation and market of Passion fruits and Cardamom. The owner of the farm also shared his experience of cultivating potato, passion fruits, paddy, and vegetables alongwith Alder tree plantation. He further went on to say that in the 1st year of cultivation, he got a good harvest on potato, out of which some tubers weighed upto 1.8 kg which is a state record. Explaining about the shifting of field he said that the land was first purchased @ Rs 350 in 1957 by his villager. Later on, seeing no other scope for development, the same was passed on to him @ Rs 30,000. After his intervention with cultivation of different crops he proudly declared that so far he has got a profit of Rs. 2.0

lakhs from this field.

He further shared his experience that he had started tree plantation alongwith paddy cultivation since 10 years back. He has now developed 5 different plots with the same techniques. The farmers were so much impressed with his hard working and enthusiasm towards not only economic activities but also on environmental protection.

The team members observed that passion fruit and Alder trees were growing very well at high degree of slope (say 30-45 degree slope). In the midst 2 different local cardamom varieties are also found growing better than exotic ones. It is good to see that cardamom had started initiating flower buds to great extent.

Not only that, different tree species available in the project and their values were also shared among the farmers. Some young ones learned about the names and values of the trees. In the process the oldest man in the team who also visited Khonoma earlier had explained his experience on Alder trees management. He emphasized how Alder trees are lopped during cultivation and benefit obtained out of it by farmers. There was heavy interaction throughout the field visit. Though they learnt from each other, yet there used to be a time that the farmers argued based on their own field experiences.

- "We have heard but we have seen now with our own eyes. When we go back home, we will do better than this farm"
- We will even share the experience gained to our villagers

In the conclusion, DSU advised the participants to experience to the extent of loss also at the initial stage so that they become more confident to get profit in the near future. Further, they were encouraged not only to be an adviser but also to be a good practical demonstrator

NEPED officials feel that such trips are very important for both farmers and officers. Farmers experience themselves that things are doable provided they have strong determination.

Concluding remarks

The farmers had planted local variety of cardamom has lesser panicles say- 4-6 nos. only; whereas suckers brought from outside produces more number of young cardamoms in a single hill. Farmers had experienced that it was best to plant 3-4 suckers in one hill so that tiller formation is faster and labour is minimized. It is observed that where shade trees are dense, expected number of tillers is not obtained cardamom, therefore thinning of shade trees to about 60% shading should be done during plantation. Once the plantation is established it was found to be difficult to thin at later stage because the plantations would be destroyed. Combination of Passion fruit and cardamom in the initial establishment is compatible because passion fruit give its best yield in the 2nd year. Passion fruit and cardamom thrives best under Alder trees.

3.4 Dimapur

Agro-forestry with black pepper have been selected to demonstrate to farmers about the crop combination of the trees and cash crop without disturbing the existing trees thereby cash crop continues to provide income to the farmers.

Rangapahar area has been selected for the plot as this area is in the middle of the district where interested farmers can easily come and learn the technique of agroforestry. Moreover, the standing trees are naturally occurring species. Standing trees are mostly *Schima wallichii, jack fruit and other local trees* which are considered suitable for black pepper crop. The area belongs to a non-governmental organization called Comprehensive Rural Development Services (CRDS) who are also engaged in imparting training facilities to rural people.

In 2002, together with the CRDS staff 2000 pits were dugged and these pits were filled with cow dung and top soil. After this operation 2200 saplings of black pepper were procured and

planted which was followed by weeding and training of saplings to the supporting trees. Weeding is being carried out periodically and gap-filling of 200 saplings was done. Further training of vines to the supporting trees was given and this continued into the second year, that is 2003.

Concluding remarks

In Dimapur Black pepper was planted at the base of already standing trees are mostly Schima wallichii, Jack fruit and other local species. The black pepper planted in April 2002, though had had good and healthy growth was yet to bear fruit in the month of November 2003. This indicates that the bearing would take place not before the third year. It also had shown that host species like *Schima wallichii* and Jack fruit are suitable for Black pepper as opposed to Gamari which was not a suitable host tree as proven in the case of Mokokchung.

3.5 Tuensang District

In Tuensang district the demonstration was taken up Yongam Village lacoted at an altitude of 650m. The altitude was suitable for Black pepper and so it was cultivated in 6.5 hectare under the existing shade trees Hollock (*Terminalia myriocarpa)*, Khokon (*Duabanga grandiflora*) and Gamari (*Gmelina arborea)* owned by 8 farming families.

Location of the village which is near the sub-division headquarters and the plot being located near the village. The need to try and demonstrate agro-cash crop for that area also was taken into consideration as that area is not covered under the main component of R/F.

Farmers were selected taking onto consideration their willingness and enthusiasm. The farmers too were progressive and they too had started cultivation of black pepper in small patches on trial. Opinion of the farmers is that they would like to extend the cultivated area under black pepper because they saw that the crop is healthy and the host trees are suitable. The farmers had also observed that it patches where other farmers had planted the crop, the trees had been preserved and were earning the owners good income.

With the increased areas under its cultivation, the farmers were apprehensive that there would be glut in the locality as such they anticipate that there would a need for training on post harvest handling so that they could compete in the market with their product. Market information on the crop for the farmers was necessary.

Concluding remarks

The altitude 650 was suitable for Black pepper and so it was cultivated in 6.5 hectare under the existing shade trees Hollock (*Terminalia myriocarpa)*, Khokon (*Duabanga grandiflora*) and Gamari (*Gmelina arborea)* owned by 8 farming families of Yongan village. The vines were doing well and showing good growth indicating that black pepper could be cultivated on Hollock and Khokon as well.

3.6 Mon District

Farmers of villages surrounding Aboi Town had taken the cultivation of cardamom as one of their main crops underneath growing trees and in some cases along with shifting cultivation. Setting up a demonstration plot on the cultivation was necessary. Therefore, three farmers were identified and demo plot was established to showcase cardamom plantation, especially the planting technique, management, and post-harvest operations. The crop was planted underneath also established Gamari and Teak plantation in both the aspects and thus comparison was possible.

Pitting for plantation of cardamom and coffee was done in the early part of March. The size pit was as per specification 15 X 15 X 15 cc pitted at a distance of 2m row to row. While the recommended time for plantation in the month of August and September, the farmers started planting in the later part of March and continued till early June. About 150 00 cardamom suckers locally collected from Chen and Chuha were planted. Survival rate was about 80%.

The leader of the demo plot is a pioneer of coffee plantation in Aboi subdivision and has been motivating farmers in and around Aboi to start planting coffee. So far his afford have a measurable success. Adjacent to his coffee farm, he has Gamari plantation of about 2.5 hectares. He was initiating to plant cardamom under this plantation. Thus the concept of establishing a demo plot jointly with NEPED was received enthusiastically.

The location of the plot is also ideal, because it is located on the roadside of Mon-Tuensang. In 12 villages of Aboi range, farmers have taken up cardamom plantation as cash crop. During the previous phase of NEPED plantation Gamari have taken up well in the jhum fields, thus the demo plot which also was done under Gamari plantation could be a show piece. In Chen Wotnyu it was observed that cardamom was doing well under this tree species. The farmers have fenced some part of the plantation but require fencing in the extended areas that are put under coffee, which was supported by the project. After the plot was established in 2001, initially harvest of cardamom started in 2002. It served as an ideal place for Farmers' Day-out where learned from each other by sharing their personal experiences.

For an instance, Cardamom growers from Ngangching and Mohung villages were invited for a Farmers' Day-out in the demo plot at Aboi. The owner of the demo plot was harvesting the crop from the plot and it gave an ideal situation for having a training session on harvesting and drying of cardamom. Moreover, the Field Officer of Spices Board of India, Mr. Gautam Goswami, was also present at Aboi, installing the 'Improved Bhatti' developed by the Board at the Demo plot.

a. Discussion on harvesting and curing processes in-situ

We took a transect walk with farmers to the demo plot, we discussed various techniques of harvesting cardamom. In the interactive process several methods of harvesting and harvesting tools were discussed. Much of the discussions took place among the farmers themselves. Some of the results of the discussions were as follows:

- The optimum time of harvest in indicated by the maturing process of the capsules starts from the base of the head and so when the top capsule dries up, it is time to harvest.
- The recommended technique for harvesting is to cut the fruit bearing stem at one a half feet above the ground ten days before the harvest. This would ensure that the metabolism process of the plant provides food to the capsule and the fruit quality is improved. The wet dry weight ratio is also reduced as a result the recovery rate is better and time of drying is shortened because moisture content is decreased. One of the farmers from Mohung village had tried this process and endorsed this fact and shared with his fellow farmers.
- Farmers of Ngangching and Mohung compared their cardamom harvesting tools. It was our opinion that the harvest knife of the Mohung farmers was handier as it does less damage to the growing stump because the cutting edge is smaller than the ones being used by the Ngangching farmers.
- The farmers learnt from the resource person the importance of washing the harvested capsules are washed immediately. This is because the fruit bearing is at the base of the clump which is in contact with the soil and therefore is soiled and susceptible to attack of micro-organism resulting in the early blackening of the capsule. The washing of the capsules prevents this process and thus retains the brownish colour.

Concluding remarks

Demonstration plot was established in Aboi of Mon district to make comparison of health and yield of cardamom with respect to aspect. There was a need also to have a live example to demonstrate that cardamom thrives better in the northern and eastern and that in the western and southern aspect requires more attention to do well.

Topographically demo plot has two aspects. One is facing south west direction covering about 1.0ha and the other facing north east covering an area of 2.0 hectares. The similarities and contrasts of these two plots make it interesting to study.

b. Both the plots have the following similarities:

- Shade trees of both the plots are Gamari (*Gmelina arborea*) with roughly equal tree population density.
- Planting materials were procured from Mohung and Chaoha villages and therefore they have the same source and same variety, Sawney,
- The planting method was similar, pitting was first done and planted after a week
- Plant to plant and row to row distance is roughly the same
- Planting of cardamom was done in August and September of 2002
- Same degree of maintenance

c. Comparison of performance in two plots

Criteria	South-west facing plot	Northeast facing plot
Approximate number of suckers planted	5000	10000
Tillering	Scanty,	prolific
General health of the crop	Some clumps were already death and empty space were observed that would require refilling	The health plants are healthy, the leaves are deep green and mortality rate is very low.
Initial fruiting during 2003	Not observed	Some plants started to bear fruit. These fruits were not harvested, as a result we observed 'in situ nursery seedlings' at the base of the clump
Assessed production during 2004	Negligible	Estimated to be 600 Kg dried capsules ready for sale from about 40% of total number of crop population were bearing fruit
Recommended variety	Should be replaced with Golsey	Sawney or Barlangi

From the above Table it was clear cardamom thrives better in the Northeast facing aspect.

4. Conclusion and recommendation

The cash crops that were cultivated in the demonstration plots were Passion fruit, Cardamom and Black pepper. In some cases farmers had planted Black pepper underneath the shade trees for tea plants and cardamom. They were planted along with the growing trees to show the compatibility of generating for farmers during the gestation period of trees.

Cardamom plantation underneath Alder (*Alnus nepalensis*) trees was found to be among the best ones at an altitude above 1400m above mean sea level. The survival rate at planting was as high as 80% and there was prolific tillering. The number of tillers was 30-40 per hill attained a height of 7-9 feet. It started to bear fruit by the second year as opposed to traditional cardamom farmers' notion of bearing fruit in the third year. The yield of fresh capsule was 1000kg in the second year of planting, which when dried yielded 200kg in 2003. Prolific

flowering was observed during flowering season in the same year and it was expected that there would be bumper harvest of crop.

At a slightly lower elevation of 1200m to 1300m altitude, it was observed that cardamom did well underneath shade trees of Gamari (*Gmelina arborea*) in the north and east aspect. But it did not do well in the south and west aspect. It is worth mentioning here that cardamom did not do well underneath Teak (*Tectona grandis*) plantation. The lesson learnt here was that at the lower altitude, cardamom should be planted in the west and south however dense is the shade.

On the management aspect, while weeding, the weeded materials when used as mulch to spread at the feet of the hill, instead of conserving moisture they prevent dews and off-season rain drops from reaching the ground and that resulted in wilting of the plant. Instead when the weeded materials were placed across the slope about one feet away from the plant, they conserved soil and moisture that resulted in improving the health of the crop.

Passion fruit did well with slight shading by Alder trees. However, this crop requires more sunlight than cardamom. Therefore, in the Passion fruit plantation areas tree stand density was sparse. In some cases, farmers had pomaded the Alder stump at height of about 2m and used it as support to spread trellis for the passion fruit vines to creep. In some cases the trellis were constructed horizontally but in most of the plantations the trellis were laid in rows at an interval of 5m. This had enabled many village farmers to innovate and improve its plantation by intercropping cardamom in between the rows. Thus the farmers were able to take up two crops in the same location. The passion fruit plantation provides shade to the cardamom.

Another innovative farmer had planted Pigeon pea near Passion fruit sapling. Since Pigeon pea is legume that germinate and grow quite fast, it served as 'ladder' for the Passion fruit to creep to the trellis that had been laid previously. The farmers were able to harvest the fruit of Pigeon pea for one year and the plant was smothered by the Passion fruit in the second year, which rotted and added humus to the soil.

Black pepper plantations with the support of Teak trees was found to be not compatible, though it found to be compatible with local tree species such as *Schima wallichii,* Jackftuit and other rough barked tree species. In Aboi, one of the farmers had planted Black pepper to creep on the shade trees for Coffee plantation. In this way farmers were able to have multiple cropping.

5. Gender role in the management of plantation

The whole farming family gets involved at every stage of the plantation from pitting and planting to harvest and post harvest processing. In all these stages gender role play is distinct. While the main job for men is pitting planting, women precede men in the preparation of pitting site and clearing the weeds with spade. Small children were also involved in helping the parents by transporting the planting materials. After planting, most of the weeding was done by women. In harvesting of cardamom, the role is also distinctly divided. The men do the plucking of head and the women do the separation of capsules from the head, cleaning and drying. Work distribution is not as distinct in harvesting of Passion fruit and Black pepper because both men and women equally take part in them.

Depending on the distance of market location and the volume of harvest men and women have their own role. In Aboi where the products are sold out to traders in town, women preferred to market the dried cardamom by themselves. This way they can ensure that the cash income generated are used in meeting the household needs. However, in those remote locations the women are not in a position to travel, the men do the marketing of the product.

In the past, traditionally men kept themselves away from tending fruits and vegetable in the field. But with the transition of agricultural system from subsistence agriculture to market economy, now both men and women play equal role in tending fruit and vegetable. With this change in the attitude of men, there is a rise in the cash income of the family.

6. Enabling factors and problems of cultivating fallow management crops

With the introduction of cultivation of cardamom cash crop along with growing trees, there had been a change in the landscape of Nagaland. In the district on Mon, the cultivation had caught up like wildfire so that one of the village elders stated that "even if we try to stop the cultivation, it will not be possible. It had caught like wildfire." One woman commented saying that "drying cardamom above the hearth is like keeping money in the bank." This was possible because farmers were easily selling their cardamom.

While the trading of cardamom was going well, in 2006 the Agriculture Produce Market Committee (APMC) Mon district issued an order to all Village Marketing Committee (VMC) to collect all cardamom product of the village and sell them to APMC @Rs45/kg whereas farmers were selling to traders @Rs.75/kg to Rs80/kg. The farmers could still had traded with the traders directly had it not been for obtaining interstate trading transit permit to transport to Assam, which these traders had to obtain from APMC Mon. The APMC having vested interest to trade cardamom all by itself refused to issue permit to these traders. As a result of this trading bottleneck, much of the product from the district were wasted in the field itself because the farmers felt that the selling price does not commensurate the production cost. It was reported that the APMC also incurred huge losses because it was stored improperly in the godown for a long period of time waiting for a better price and was infested by fungus. In other districts like Phek, Wokha and Zunheboto, although the price was lower than the previous years, the farmers were able to sell their product at reasonable price of Rs.75/kg in Dimapur.

Passion fruit growers were able to directly transport their product to the Passion Fruit Processing Factories at Punanamai of Manipur, Nagaland Industrial Product of Dimapur and Longnak Fruit Processing Factory. Those farmers who had realised that their product could be sold and generate income for the family expanded their plantation areas and also more farmers joint in and the production from the village increased. However in those villages where the farmers had been trading passion fruit at local market were still finding difficulty in marketing their surplus produce. The reason was that these farmers were expecting a higher price for their produce, which they were getting from retailing them in the local market. However, though they are aware of the fact that the quantity they could market is limited to local consumption which is not very high, these producers are reluctant to part their produce to Factories at a lower price in bulk.

The above analysis showed that there are two main issues that require attention:

1. Appropriate technology for value addition to be identified and made available to the producers. In this, the technology should consider the fact that power is not available in the villages much less in the production site which is located even at 5km away from the village where power is available. Therefore the technology should be such that the drier is portable and energy source is firewood.

Capacity building on post harvest technology and awareness creation on marketing especially pricing is needed to be imparted to the producers.

6.1 Fallow Management: Research results from SARS

Many villages in Nagaland have short jhum cycles. This short fallow period drastically reduces the yield of crops because there is less time to rebuild the soil fertility. In order to help the farming communities facing the crisis of short fallow period, an appropriate technology is needed. Planting of leguminous trees, shrubs etc have shown to restore the soil fertility in a short time. Initial studies on Tithonia for improving the soil fertility have been conducted by Malcolm Cairns, a Research fellow with ICRAF and Amenba Yaden. Basing on their report SARS initially started an on-station trial and later on disseminated the technology to the farmer's field.

OBJECTIVES:

1. To improve soil fertility status
2. To study weed infestation.
3. To study paddy yield as influenced by Tithonia.

IMPORTANCE:

Tithonia (*Tithonia diversifolia*) is a very useful plant which can be grown during fallow period especially in short jhum fallow. It can easily establish in any kind of soil and contributes large quantities of organic matter as well as NPK to the soil. It has a good root system that helps to arrest soil erosion and its canopy suppresses weeds. Keeping in view of the beneficial effects of Tithonia, the NEPED research SARS team initiated on station as well as on farm trials on paddy cultivation after Tithonia.

1. On Station paddy cultivation and its yield after Tithonia.

In the 2nd year jhum, Tithonia cuttings were planted and kept fallow for 4 years. In the 5th years Tithonia plants were cut, burnt and cleared during the month of February 2004. Normal jhum cultivation practices were followed throughout the cropping period. A control plot where Tithonia was not grown was also cleared and paddy was sown. Both treated and control plot had an area of 54 sqm and paddy variety used was Sungmang tsuk. Soil test from both the fields were done before sowing of paddy.

RESULTS AND DISCUSSION:

From table 11 it can be clearly seen that Tithonia played a vital role in enhancing soil fertility. The table shows increased soil nutrient contents which ultimately enhances better growth and increase in yield of paddy. Comparative study of paddy yield between treated and control plots are presented in table 12. As high as 10.2 Q/ha increase in yield was recorded from the treated plot.

Table 11: Soil fertility status in treated and control plots.

Characters	Units	Control plot	Treated plot
pH	-	4.97	5.12
EC	-	0.1	0.1
OC	%	1.65 (H)	2.1 (H)
P2O5	Kg/ha	7.0	9.25
K2O	Kg/ha	48.9	160.2

Table 12: Yield of paddy (Q/ha)

Treatments	1st year	2nd year
Control	7.4	1.2
Treated	17.6	11.5

Minimum weed infestation was also recorded in the treated plot as compared to the control plot. It was also interesting to note that there was no thatch grass in the treated plot whereas there was heavy infestation in the control plot, therefore more labour inputs were required for cleaning the weeds. Weed density in both the plots of two years are given in table 13.

Table 13: Weed infestation (No/sqm)

	1st year		2nd year	
Characters	Treated	Control	Treated	Control
Narrow leaves	154	296	48	9
Broad leaves	183	178	168	706
Weeds/sqm.	337	474	216	725

2nd year paddy was continued following the same cultural practices as in the 1st year. General performance of plant growth and health was not satisfactory as compared to 1st year crop, especially the control plot. Perusal of the above table 12 clearly shows that the yield of paddy decreased in the 2nd year. Drastic reduction in yield is also seen in the control plot. The reason for lower yield in the 2nd year may be due to the fact that paddy being a heavy feeder of nutrients might have used up large quantity of nutrients by the 1st year crop and as such there are no sufficient plant nutrients for the 2nd year crop.

With regard to weed population, more number of weeds was observed in 2nd year as compared to 1st year. Nevertheless, there was a significant difference in weed population between the control plot and the treated plot. As high as 725 weeds/sqm were observed in control plot whereas in treated plot only 216 weeds/sqm were recorded.

Yikhum

The trial was taken up during the year 2004. Tithonia cuttings were planted at a spacing of 1m x 1m during the month of August (before the harvest of paddy) in an area of 2 acres. The paddy yield of the 1st year (before intervention) is given in table15 . Soil analysis of the field before Tithonia was done, however, since the field is not yet ready for cropping soil analysis after Tithonia and accumulation of biomass has not been completed. Soil test report is given in table 14.

Table 14: Soil status report.

		Tithonia	
Characters	Units	Before	After
PH	-	4.76	
EC	-	0.1	Field not yet slashed
OC	%	0.33 (L)	
P2O5	Kg/ha	5.0 (L)	
K2O	Kg/ha	224 (M)	

Table 15: Yield of paddy and Tithonia biomass (Q/ha)

Crops / Years	Paddy	Tithonia Biomass
1st	11	
2nd	Not yet cropped	Field not yet slashed

OBSERVATIONS:

It was observed that the survival percentage of the Tithonia cuttings were poor in the first year. This may be due to late planting of the cuttings (end of August). Therefore, the cuttings were replanted during the month of June 2005 and so far the establishment and growth of the cuttings are growing well. The plants will be managed for 4-5 years followed by cutting down and then cultivate paddy.

Farmers experience:
One farmer initiated his own experiment by digging a pit, collected the leaves of Tithonia and dumping it in the pit. After few days pumpkin seeds were sown in the decomposed Tithonia leaves. To his surprise the pumpkin vines grew very healthy and harvested more than 60 pumpkins from a single vine. After this practical experience, the farmer is very much convinced that Tithonia plants are indeed a good source of organic fertilizer which can boost up the productivity of a degraded soil.

Longkhetpeh :

This village comes under Tuensang district having a jhum cycle of 4 years. The farmers usually cropped for two years and from the 3rd year onwards they cultivate on leased land basis from the neighbouring villages for the next two cycles and then go back to their own jhum fields. SARS team intervened in the village by imparting training and introduced Tithonia as a short jhum fallow management during the year 2006 by planting the cuttings in July. The plants are now well established in the fields which will be retained for about 4 years before paddy cultivation takes place. Soil test report of the fields is given in table 16.

Table 16: Soil test report

		Tithonia	
Characters	Units	Before	After
PH	-	5.05	Field not yet slashed
EC	-	0.3	
OC	%	1.4	
P2O5	Kg/ha	10.0	
K2O	Kg/ha	76.0	

Mopungchuket:

In Mopungchuket, Tithonia was planted on trial basis in a depleted soil condition. Cuttings were planted in the month of June. Survival rate was 60% which are growing well. The main objective of the test plot is to study the effect of Tithonia plants to rebuild the depleted soil.

Table 17: Soil test report

		Tithonia	
Characters	Units	Before	After
PH	-	5.0	Field not yet slashed
EC	-	0.3	
OC	%	1.6	
P2O5	Kg/ha	13.0	
K2O	Kg/ha	127.0	

Conclusion:

In all the test plots Tithonia plants have established properly and performing well. The plants will be left undisturbed for another 4 – 5 years before cultivating paddy. After 4 years the Tithonia plants will be slashed, burnt and paddy cultivation will take place following the normal practices of jhum. Therefore, yield of paddy after Tithonia and biomass of Tithonia can be obtained after the cropping period.

6.2 Soil Conservation

Loss of fertile top soil caused by soil erosion is another aspect which is detrimental to crop production. Naga farmers usually use barriers to check soil erosion but it is not used in a systematic manner, hence most of the soils get washed off during heavy rains. NEPED research SARS evolved various mechanical and vegetative barriers to control soil erosion and introduced this measures in the farmers fields according to the material availability and farmers choices. The works carried out in different locations are described below.

1. Yikhum

In this village soil conservation measures using bamboo splits and vegetative barrier with colocassia were used where significant result were obtained. Bamboo split barriers of 1ft high were laid across the slope at a spacing of 4 – 5 mts depending upon the degree of slope. Soil accumulation was observed to increase with every intercultural operation. After the end of 1st year it was observed that a good amount of soils were collected in the barriers. Colocassia which were also sown in the barriers were quite healthy and gave a good yield.

2. Chare

In chare soil conservation with bamboo splits was taken up. The degree of slope of the fields was so high that in uncontrolled fields there was a high rate of soil loss. Construction of soil conservation measures showed significant impact. Appreciable amount of soils collected in the barriers at the end of cropping seasons. Crops grown in the barriers were also observed to be healthier than those grown in the alley ways. This clearly indicates that all the fertile top soils which would have otherwise been used by the crops are being washed away during the cropping season.

3. On Station empirical study on soil conservation measures with bamboo slits.

An On-Station trial on soil conservation measures using bamboo slits was carried out in the jhum field having 30 – 50 degree slope. The barriers were laid at a spacing of 4 mts apart. Normal jhum activities were followed and after every intercultural operation, measurement of soils accumulated in the barriers was taken with the help of calibrated stick till the harvest. It was observed that the quantity of soil loss increased throughout the cropping period especially after every intercultural operation followed by heavy rains. This clearly indicates that the soils loosened during intercultural operations are easily washed off by rain water and thereby striping the land

Off its fertile top soil making it less productive. The level of soil accumulation in the barriers after every intercultural operation is presented in the table 18.

Table 18: Level of soil accumulation in the barrier in cm
(Av. of 10 points/row)

Row No.	1st weeding	2nd weeding	3rd weeding	Average
1 (33%)	4.67	6.34	7.89	6.3
2 (35%)	5.0	6.0	7.1	6.03
3 (40%)	7.0	8.34	9.41	8.25
4 (40%)	7.0	9.0	9.98	8.66
5 (35%)	5.67	7.86	8.89	7.47
6 (35%)	5.34	7.34	8.99	7.22
7 (30%)	3.67	5.33	7.12	5.37
8 (40%)	7.67	9.34	9.89	8.97
9 (33%)	5.0	8.34	9.78	7.71
10 (48%)	8.34	12.344	13.40	11.36
Total	59.36	80.23	92.45	
Average	5.94	8.02	9.24	

Parenthesis indicates percentage of slope.

From the above table it can also be seen that soil accumulation varies from row to row which shows that soil movement depends largely on degree of slope.

4. Soil conservation measures using live barriers (broom grass, Tithonia).

The NEPED Research SARS team initiated soil conservation measures using live barriers such as broom grass and Tithonia for controlling soil erosion. The live barriers were planted during the month of March 2005 at a spacing of 4mts apart. Maize crop was grown in the alley ways of the barriers. Timely pruning of the barriers was done to avoid shading on the maize crop.

OBSERVATION:

Broom grass and Tithonia established fast and the growth was also satisfactory, especially the broom grass. Maximum suckers developed in no time covering the spaces in between two plants. Tithonia also shed leaves and added bio-mass to the soil thereby improving the soil fertility status.

At the end of cropping season, good amount of soil (5 – 8") accumulated in the barriers developing into a permanent terraces. Since fertile soil loss is checked, the crop (maize) grown in the alley ways was also found to be
very healthy giving a yield as high as 15 Q/ha. Good quantity of leaf yield was also obtained from broom grass
which was used as cattle feeds and also broom sticks?

5. Mokokchung village

In Mokokchung village, bamboo splits were used as soil conservation measures. The barriers were constructed using an 'A' frame all across the slope. In the barriers Arhar was grown at a closer spacing with a view to support the barriers. Arhar crop showed a significant compatibility with other crops with a good harvest. The crop has been harvested but the plants are left standing after cutting back to 1 ft from the ground level. This is done in order to give support to the barriers as well as to get ratooning crop in the next year since it is perennial in nature.

6.3 Agro-Forestry

Young trees, especially newly planted, require timely care and maintenance for its proper growth. Weeds cause a major problem by interfering with the tree growth. Hence, agro-forestry with shade loving crops was introduced with the aim to manage this young trees while managing the under crops. Crops like cardamom, pineapple, ginger, turmeric etc are mainly used as the shade loving crops in agro-forestry system.

OBJECTIVES:

1. To manage the young trees.
2. To earn extra income from the fallow crops till the trees are harvested.

1. Wokha:

Agro-forestry with cardamom was introduced in Wokha village under Alder plantation in the year 2004. The plantation area was cleaned and planting materials (suckers) were supplied to the farmer for planting during the month of April. The crops have established properly and are doing extremely well. Timely cleaning of the field and timely supervision and documentation of the activities are being done.

2. Sungratsu:

In Sungratsu also cardamom was grown as the fallow crop under alder plantation. About 800 suckers were planted and percentage of establishment is 90 %. The crop is doing well and also the trees are properly managed while managing the fallow crop.

3. Kobulong:

In Kobulong, pineapple was used as the fallow crop. The crop was introduced in Agar plantation. The farmers have already started harvesting the pineapples which are being sold in the market and earning a good income.

6.4 Control of Thatch Grass Using Tithonia.

Thatch grass (*Imperata cylindrica*) is found in abandoned jhum fields. It grows fast and spread extensively which becomes difficult to control or eradicate once it establishes. Use of Tithonia (*Tithonia diversifolia*) is one such method for suppressing the growth of thatch in the fields. Based on test, the research team introduced Tithonia in thatch grass infested fields.

Materials and Methods:

Tithonia cuttings were planted in fallowed thatch infested jhum fields during the month of April. The thatch grass were first slashed and cleaned before planting took place. The cuttings were then allowed to established and grow without disturbing it for the whole year.

Observation:

Casual observation after the 1st year showed 70% of thatch grass being suppressed. Remaining 30% also exhibited sickly growth. 2nd year shows almost same result with the 1st year, however, at the end of the 3rd year complete suppression of the thatch was observed. This suppression is due to heavy shading effect of Tithonia because thatch by nature is intolerant to shade. Hence, it can be recommended that Tithonia should be grown in areas where thatch infestation exists.

6.5 Multipurpose Tree Species in Jhum Fields.

A number of multipurpose tree species are available in jhum fields. Farmers have been growing these tree species for their various needs but without giving serious thoughts about its economic values. The indigenous plants that grow in jhum fields have multiple uses viz. food, fodder, medicine, manure, fuel, timber, handicrafts, fibre etc. Therefore with a view to educate the farmers about the various economic uses of trees the project was taken up which involves visiting of jhum fields, identifying tree species and studying their uses. Among the various tree species Alder is the most prominent and extensively used.

1. Alder (*Altus Nepalese's*): This tree since time immemorial has served the Naga farming community and shall continue to do so. It is the most commonly found tree species which grows at an altitude ranging from 1000 – 2000 M. the use of Alder tree has shown a way of exploiting and conserving together. It is a process of not destroying a forest while putting the land under cultivation. Various uses of Alder are:
    a. Agriculture: It enriches the soil than any other trees. Both primary and secondary crops are grown under alder tree fields. It is also used as shade for coffee, cardamom and tea.
    b. Firewood and Timber: It is fast growing and yields good quantities of firewood. The matured wood is used for constructions and making furniture's.
    c. Soil Conservation: The roots do not grow very deep and tends to spread sideways which help soil binding and prevent erosion.
    d. Local Uses: Crushed shoots are used to stop bleeding of external injuries. The sap extract is used for treatment of dysentery.

Other important multipurpose tree species are:

2 Tita chapa (*Michelia champaca)*: It is a hard wood and gives good quality Timber. Wood is used for posts, veneers, furniture's and decorative fittings. Flowers are used for preparation of perfumes and hair oil and also used as yellow dye for textiles.

3 Black siris (*Albizia lebbeck)*: It gives a high quality timber and used extensively for making furniture's, carvings, flooring and decorations. It is resistant to termite attack and can with stand moisture.

4 Needle tree (*Schima wallichi*): It is used as timber but mostly used as firewood.

5 Dalchini *(Cinnamomum zlylanicum*): Wood is used for posts, firewood. Bark is used as spice and c heck na usea and vomiting. T he oi l ex tract i s us ed i n f lavouring confectionery, pharmaceuticals and soaps.

6. Bauhinia (*Bauhinia variegate)*: Wood is used for fuel and making various agricultural implements. Leaves are used as fodder. Flowers and pods are eaten as vegetables. Bark is used for dyeing.

7. Mejankori (*Litsea citrata)*: It is extensively used as fuel and also as insect repellent. Fruit is used for making pickle; oil from flower is used in perfumes. Fruit extract is used for treating dizziness, headache and paralysis.

8. Nettle tree (*Trema orientalis*) : Most abundant in fallow lands. Wood is used for match boxes, tea chests, shoe heels etc. Bark is used as ropes. Fruit is edible, leaves are used as fodder and root extract is used to treat diarrhoea.

9. Rattan (*Calamus tenius*) : The c anes are us ed for m aking baskets, m ats, f urniture frames, walking sticks and shields. Fruits are eaten raw.

10. Mechinga (*Zanthoxylum acanthopodium*): It is termed as vegetable tree. Wood is used for making walking sticks. Young leaves, shoots and seeds are eaten as vegetables. It is also used as spice and medicine for stomach disorders

11. Bamboo (*Bambusa* spp.) : It is grown by almost all the Naga farmers and wild varieties are al so r eadily av ailable. It i s ex tensively us ed i n al l types of c onstructions, m aking various types of mats, baskets, decorative materials, furniture's etc. Seeds are used as grains.

6.6 Survey on Use of Salt as Weedicide

For the last many years farmers of Nagaland have been using common salt (sodium chloride) for c ontrolling w eeds, es pecially br oad-leaved w eeds, i n t heir j hum f ields. C ommon s alt i s probably t he m ost ef fective an d s afest w eedicide. H owever, in s pite of i ts r ole i n c ontrolling weeds, there are also reports that use of salt has negative impact on the natural vegetation and crops. T he r eason f or t his c ould be due t o ex cessive us e ac companied by w rong t ime of application.

The NEPED research SARS team therefore conducted a s urvey to study farmer's perception on t he us e of s alt a nd i ts ef fect on v egetation a nd qual ity of rice i n different v illages o f Mokokchung, Tuensang and Wokha districts. Semi-structured interviews were conducted with the farmers and the general information on the use of salt was originally started from Ungma village und er M okokchung di strict. H owever, some v illages i nitially r efused t o ac cept t he concept of s alt as w eedicide es pecially Longk hum b ecause t hey ha d no pr oper i nformation about the technology and also they were concerned about the cost involved during purchase and transportation of salt. Nevertheless, they have started using salt extensively since the past 20 years.

In the lower region (Tuli area) however, us e of salt as weedicide started since 4 – 5 years back only. In Tuensang and Wokha districts, use of salt was learnt from Mokokchung district since 10 years back and now they are using extensively. General Farmer's perception on the impact of salt usage is presented in table 19.

Table 19: Farmers' perceptions.

Merits	Demerits
1. Controls weed effectively especially broad leaf weeds. 2. Takes shorted time to control weeds as compared to other weedicides. 3. It can check the weeds for at least 20 days after its application whereas hand weeding checks for short duration only 4. Very effective and reliable. 5. Safe and easy to use. 6. It is a selective herbicide and hence does not affect rice plant. 7. It loosens the soil for better working on the soil. 8. It is easily available and cheaper than other commercial herbicides. 9. 1 bag of salt is sufficient to control weeds which is equivalent to 10 man days work and reduces 50% of the cost on labour during weeding. 10. Reduces number of weeding operations. 11. It enhances better plant growth. 12. Yield of paddy is increased. 13. Secondary crops like green chillies yield better. 14. It kills leeches, common grub, cutworms and also repels rats from the field.	1. Controls only broad leaf weeds and encourages more narrow leaf weeds which becomes more or less dominant in the field. 2. The soil becomes loose and enhances soil erosion. 3. If salt is applied during the reproductive stage, it adversely affects the yield of paddy. 4. Percentage of chaff is more in salt applied field. 5. 5% of grains are reduced after milling as compared to grain yield obtained from hand weeding. 6. Less starch content and hence rice is not sticky. 7. Quality (taste) is reduced. 8. Poor cooking quality. 9. Cooked rice cannot be stored for longer period. 10. Some of the vegetable species like Mejinga and Emrem and also some local tree species are found to have been disappeared due to use of salt. 11. Reduction of beneficial worms (Earthworm) in the fields.

6.7 Researchers Observation

1. During the survey period effect of salt on growth and yield parameters of paddy were also recorded. The following observations were made: Plant height-144cm, No. of effective tillers/hill-4.8 and grain yield-42.8 q/ha.
2. It was also observed that application of salt kills even sedges. This observation is in conformity with the findings of Dr.V.M. Bhan.
3. Disappearance of tree spp. is mainly due to destruction of mother trees.

According to the present controversy over use of salt in Nagaland whereby all the natural vegetation is killed i.e. natural regeneration of forest is deteriorated; it does not prove true as long as salt is used in the right dosage. This is substantiated with the report of Dr. M.C. Talukdar whose study proved that use of common salt as weedicides (in acid soil) does not warrant any long term danger to the flora and fauna.

Present trend:

Observation of recent trend on the use of salt in jhum fields has been found to be minimizing to a great extent. The reasons are; the research team has been creating awareness to farmers in different villages through conducting trainings and field days on judicious use of salt as excessive use affects both flora and fauna. It is also observed that even year the sale of salt in all the retail shops have been reduced significantly mainly because demand of salt by the farmers is minimum due to use of optimum dosage.

Weed population and their classification:

No. of observations	Classification	Weed population			
		1st year jhum		2yr year jhum	
		Treated plot/sqm	Control plot/sqm	Treated plot/sqm	Control plot/sqm
1stobservations	NL	557	587	621	654
	BL	547	582	392	701
2nd observations	NL	520	430	630	298
	BL	8	582	20	463
3rd observations	BL	532	441	634	307
	NL	40	686	31	472

*1st observations= Before weed control operations, 2nd observations= After weed control
3rd observations=After harvest of paddy, @NL=Narrow leaves, BL=Broad leaves.

HOW FARMERS USE SALT IN THE FIELD

1. 2 kg salt mixed in 10-15 lts of water. They spray 2 times (May/June/July) during a cropping season.
2. Some farmers mix 2 bottle caps of diesel with the salt solution for more effective control and also to check rodents.
3. Soap is also added by some farmers in the salt solution for its adhesive nature.

Conclusion:

The use of salt inevitably raised questions about possible deleterious soil and crop effects. Sodium may be toxic to crops, especially in dry climates with naturally high salt levels in soil. However, under Nagaland condition rainfall is high which leads to rapid leaching of sodium and hence it does not create toxicity to the crops. Moreover, based on research works, it can be concluded that if salt is used as per recommendation it does not create any danger to flora and fauna.

Recommendation:

1. Salt should not be applied in alkaline soil and permanent farm lands.
2. Only the optimum dose i.e. 1 kg of salt dissolved in 12 litres of water, should be used and that too only one application in a single cropping season.
3. Apply salt within 45 to 50 days after germination of the rice plant.
4. Combine the application of common salt with Agronomic practices like soil conservation measures.
5. Hot sunny days and rainy days should be avoided.
6. Adding a small quantity of washing powder in the salt solution is helpful as this will act as a sticking agent.
7. Good quality sprayers enable better coverage. Knapsack sprayers are preferred.
8. After application of salt intercultural operations should be carried out.

Several scientists gave their on the use of salt: Dr. C.M Singh (Agronomist and Weed Scientist) commented that: common salt is one of the worlds earliest weedicide; it is also known to have been used as weedicide in many countries before the advent of modern commercial weedicide and salt is now being rediscovered as weedicide. Dr. V.M. Bhan (Agronomist/Weed Specialist) remarked: the modern commercial weedicide like 2,4-D and conventional common salt are sodium based and like common salt, application of Na salt of 2,4-D can kill even sedges up to 90 % besides increasing yields significantly. Dr. M.C. Talukdar (Soil Scientist) observed that: literally, when Na is high in the soil it disperses the clay particles because Na is a dispersing agent. However, the bottom line is that, buffering capacity is always present to help arrest the displacement of soils. He also stated the use of common salt as weedicide (in acid soils) does not warrant any long term dangers to the flora and fauna.

6.8 Study of Weeds under Different Altitudes in Jhum Fields and Permanent Farm Lands

The occurrence of different weed species and their distributions are greatly influenced by climatic as well as soil factors. The climatic factors that cause changes in weed flora from one place to another are rainfall, light, temperature, wind and humidity. Rainfall and water have significant effect on weed distribution. Thus, the rainfall of a particular region is the determining factor for occurrence of weed species. Soil factors include soil pH, soil fertility, soil water, soil aeration etc.

It is generally known that some weed species are characteristically alkali plant known as basophiles. Similarly, weeds found in acidic soils are acidophiles and weed which mostly grow under neutral soil condition are neutrophiles. The ecology and distribution of these weeds vary greatly with numerous factors. Weeds occurring in one particular region do not occur in another situation. Hence, a study on the ecology of various weeds, their distribution in relation to soils; climate etc has been conducted during kharif season 2006 by the NEPED (Res) team. Two locations were identified, one at Tuli area i.e. lower altitude and second at Yisemyong i.e. mid altitude (above 1000 msl). The annual rainfall in these two locations is 1500-2500 mm and soil reaction is acidic.

Objectives:

1. To have an idea about weeds present in a region.
2. For proper and effective control of weeds.
3. To identify and study different weed spp. and their intensity of infestation.

Methodology:

- Weeds were collected from the jhum field as well as from permanent farm lands from mid and low altitudes.
- Identification was done on the basis of broad leaf and narrow leaf and reference from literature.

Observation:

A total of about 74 different weed species were collected during the survey, out of which 55 spp were broad leaf representing 74.32% of total weed spp and 19 nos. of weeds spp. were narrow leafed i.e. 25.67% of the total weed spp. Different weed species found are given in tables 20, 21 and 22 (See page-)

Table 20. Major weeds found in mid altitude

Botanical name	Common name	Family
Erechthites valeriannaifolia	Fire weed	Composeteae
Mekania micrantha	Hemp weed	Composeteae
Commelenia benghalensis	Tropical spider wort	Composeteae
Eupatorium odoratum	Siam weed	Composeteae
Bidens pilsa	Beggars stick	Composeteae
Borreria hispeda	Button weed	Rubiaceae
Amaranthus spinosus	Spiny amaranth	Amaranthaceae
Amaranthus viridis	Amaranth	Amaranthaceae
Centella asiatica	Indian pennywort	Umbelliferae
Euphorbia hirta	Hairy spurge	Euphorbiaceae
Oxalis corymbosa	Wood sorrel	Oraliolaceae
Oxalis cormiculata	Creeping sorrel	Oraliolaceae
Plantago major	Greater plaintain	Plantaginaceae
Phyllanthus niruri	Bheri amla	Euphorbiaceae
Eclipta alba	False daisy	Compositeae
Arundinella bengalensis	Topasoli	Gramineae

Table 21. Major weeds found in low altitudes.

Botanical name	Common name	Family
Cassia accidentalis	Coffee senna	Leguminoceae
Cassia tora	Foetid cassia	Leguminoceae
Chenopodium album	Smooth pig weed	Chenopodiaceae
Desmodium laxiflora	Hairy tick trefoil	Leguminoceae
Melastoma malabathrium	Indian rhododendron	Malastomaceae
Lantana camara	Lantana	Verbaneceae
Euphorbia thymifolia	Spurge	Euphorbiaceae
Polygonum hydropipes	Water pepper	Polygonaceae

Botanical name	Common name	Family
Polygonum perfoliatum	Water pepper	Polygonaceae
Sida rhombifolia	Sida hemp	Malvaceae
Sida carpinifolia	Snakes tongue	Malvaceae
Spermacoce ocymoides	Button weed	Rubiaceae
Urena lobata	Aramina cedilla	Malvaceae
Verbena officinalis	Vervain	Verbenaceae
Pteridium aquilinum	Kuhu brachen	Polypodiaceae
Argemone mexicana	Prickly poppy	Papaveraceae
Parthenium hysterophorous	Congress grass	Asteracea (Compositae)
Capsella bursa pastoris	Mothers heart	Cruciferae
Axonopus compressus	Carpet grass	Graminae
Eragrostis unioloides	Stink grass	Graminae
Mollugo pentaphylla	Indian check weed	Aizoaceae
Monochoria hastaefolia		Pontederiaceae

Table 22: Common weeds found both in mid and low altitudes.

Classifica- tion	Botanical name	Common Name	Family
	Eleusine indica	Goose grass	Gramineae
	Cynodon dactylon	Bermuda grass	- do -
	Digitaria sanguinalis	Crab grass	- do –
	Setaria gluca	Fox tail grass	- do –
	Paspalum conjugatum	Sour grass	- do –
	Imperata cylindrica	Thatch grass	- do –
Narrow leaf.	*Echinochloa colonum*	Wild rice	- do –
	Panicum repens		- do –
	Oplismenus compositus	Basket grass	- do –
	Paspalum scrobiculatum	Koda millet	- do –
	Saccharum spontanum	Wild cane	- do –
	Setaria palmifolia		- do –
	Chrysopogon aciculatus	Love thorn	- do –
	Cyprus rotundus	Nut grass	Cyperaceae
	Cyprus spp.	Yellow grass	- do -
	Cyprus difformis		- do –
	Dactyloctenium aegyptium	Crow foot grass	Gramineae
	Phragmites communis	Common reed	- do -
	Cyprus pilosus	Harkota bori	Cyperaceae
	Fimbristylis miliacea	Lesser fimbristylis	- do -
	Bonnaya reptans		Scrophulariaceae
	Digera arvensis		
	Elephantopus scaber	Elephants foot	Compositeae
	Eryngium foetidum	Sea holly	Umbelliferae
	Fragaria indica	Wild strawberry	Rosaceae
	Hedyotis lineate		Rubiaceae
	Hydrocotyle rotundifolia		Umbelliferae
	Melilotus alba	White sweet clover	Leguminoceae
	Nasturtium indicum	Water cress	Cruciferae
	Oldenlandia corymbosa	Parpata	Rubiaceae
Broad leaf	*Oldenlandia diffusa*		- do -
	Peperomia pellucida		Piperaceae
	Physalis mimima	Chinese lantern	Solanaceae
	Polanisia icosandra	Spider flower	Capparidaceae
	Portulaca oleracea	Purslave	Portulacaceae
	Rungia repens		Acanthaceae
	Scoporia dulcis	Sweet broom weed	Scrophulariaceae
	Solanum khasianum	Horse nettle	Solanaceae
	Solanum nigrum	Blake night shade	- do -
	Stellaria media	Start wort	Coryophyllaceae
	Lycodium flexuosum		Schizaeaceae
	Lycodium microphyllum		- do -
	Dioscorea pentaphylla	Kanta alu	Dioscoreaceae
	Athyricum felix-femina	Lady fern	Athyriaceae

Conclusion.

Except for some few weed species, weeds collected from both the two locations were similar in case narrow as well as broad-leafed weeds. This is because both location/areas come under the same soil type i.e. acidic soil and receive almost the same amount of annual rainfall.

6.10 Study of Cardamom Mortality

Large cardamom, commonly known as 'Bada elaichi' is being grown in most parts of Nagaland. It is well adapted to the climatic conditions of the state and many varieties are being brought in from other parts of India for commercial cultivation. Farmers have taken a keen interest in cultivating this crop for its pot entiality and for the return it gives. The crop has been in cultivation for the last several years without any serious disease problems. However, during the year 2005 a major disease problem was reported from almost all the large cardamom growing farmers. Therefore, NEPED Research SARS team conducted a survey-cum-study in cardamom fields with the following objectives:

Objectives:

1. To identify the nature of damage and the causal organism.
2. To identify appropriate control measures/management practices.

Methodology:

The study was conducted in the disease infected cardamom fields during the year 2006. Samples of infected plants were collected from various fields and brought to the station for study. The sample was also sent out to other laboratories for identification of the disease and its causal organism. Consultation from literatures of Spice Board of India was also done for confirmation of the findings.

Findings:

The studies revealed that the damage was due to a disease called *Fusarium* wilt caused by *Fusarium oxysporum*. It is one of the most devastating diseases and is very much destructive to productivity. The disease causes heavy damage in nurseries as well as in the main field in which the whole clump dries up. Sudden wilting of the plant or individual leaf is the characteristic symptom of the disease. The first external symptom is chlorosis of the older leaves accompanied by collapsing while still green. In this way all the leaves eventually collapses leaving the pseudostem standing. Internally, vascular discolouration (brown to black) is seen in the outer leaf sheath, throughout the pseudostem. Almost all the rhizome may be invaded turning black and is peeled off easily.

Continuous rainfall during flowering period, water stagnation and old plantations with degenerated clumps were found to be favouring the spread of the disease.

Recommendation:

1. Cultural practices such as rouging of plants, field sanitation by providing drainage in nurseries and plantations, removal of diseased debris and weeds are effective in controlling the disease.

   Drenching/spraying the field once or twice before the onset of monsoon and just after flowering with Bavistin (0.3 %), Captafol (0.2 %), Dithane M-45 (0.25 %), drenching the soil with Thiram (0.2 %) or Dithane M-45 (0.25 %) in and around the clumps are effective for controlling the disease.

6.11 Study On Various Tree Management in Jhum and Forest Lands (Past and Present) Through PR &D in Mokokchung District

Background:

Till 1890 many valuable tree species were found abundantly in jhum areas for the following reasons:

1. The idea of commercial exploitation of trees was not known.
2. No. good tools and implements for cutting down of big trees were available.
3. Due to superstitions and beliefs, some tree species were completely left untouched but rather preserved.
4. In some specific locations, especially in worship and sacrificial places, sacred grooves were maintained and preserved permanently.
5. Maintain community forest land from where only selected trees were cut down for use in community works construction and sometimes during emergency and natural calamities like fire accident etc.
6. Culture and tradition also plays an important role where many trees species were specifically preserved to be used only for specific purpose.
7. Village authority also plays an important role where in some villages the council make legislations to preserve certain valuable timber trees and edible fruit trees within the village land.

However, in the present context, all these traditional good practices are fast vanishing leading to disappearance of many of the valuable tree species (became extinct). Therefore, keeping in view the need to revive the almost lost practices of tree preservation and management in jhum areas, the present study was undertaken with the following objectives:

Objectives:

1. To ascertain how farmers manage trees in the jhum fields and fallow periods in the past and present situations.
2. To document various practices of tree preservation and management on need basis adapted by the farming communities.
3. To study good practices which need to be incorporated and modified that are best suited to the present context.
4. To project and incorporate in the management system the rare species that can be revived and preserved.
5. To encourage the farming communities to go for various options of suitable tree management systems of their choice.

Methodology:

The study was conducted in 4 (four) villages, namely, Mopungchuket, Longkhum, Khensa and Ungma under Mokokchung district having 9 – 12 years jhum cycles. The selected villages were the pioneer having legends in tree preservations in the olden days. Hence, taking into consideration about their traditional practices, they were selected as the study villages during the year 2006. Meetings with the farming communities comprising of village council chairman, council members and farmers were organized and various issues on the preservation and management of tree species both in the past and present were discussed in detail. The findings/observations of the meetings are presented below under different heading.

Dominant tree species found:

The following were the different tree species found in the study villages : Tita Chapa (Mechilia Champaca), Bonsom (White), Gamari, *Ngurong Nukti, Atsuyimpang, Nunga,* Gora neem, *Tsungko,* Khokon, Bonsum (Red), Alder, walnut, Iron wood, Agar, Schima wallichi, *Sungpet, Ongtong,* Ficus bengalensis, Wild chestnut, Macaranga, Trema orientalis, *Zukum, Mango tsupen, Metsu tsupen, Alongmetong,* Palm tree, *Jarem,* Spear tree, *Pupang sung*, Hollock, Rubber tree, Banyan, Oak, Silk cotton tree, Albizzia spp., Litsea spp., Dhona. Soapnut tree,

Goose berry, Melastroma, Acid berry

Tree that regenerates earlier :
Trema orientalis, Macaranga , Schima wallichi *, Zukum, Meset, Sungken,* Acid berry

Tree preserved for various purposes :
Tita chapa, Bonsom (White), Gamari, Alder, Iron wood, Agar, Schima wallichi, *Ongtong, Mepet, Tsungko,* Khokon, Bonsum (Red), Gora neem*, Hollock*, Khokon, Silk cotton tree, Albizzia spp., Banyan and all the wild fruit trees.

Note : Italic indicates name in local language (Ao).

System of tree management in different villages is given in table 21.

Present practices:
After the commercial exploitation of trees both for timber and supply of logs to the mills, all the big trees reserved from time immemorial were randomly cut down without any thought for future. Hence, nowadays almost all the big and valuable tree species have vanished and along with it the mother trees, which are the main source of regeneration.

After the launching of NEPED, massive tree plantation programmes were started and now awareness has been created in the mind of the farmers to plant and preserved trees. It is high time for both individuals as well as the village authority to make resolutions to conserve trees and go for massive tree plantation.

Note: Italic indicates name in local language (Ago).

System of tree management in different villages is given in table 21.

Table 21: Comparative study of tree management system in different villages

Sl. No	Types of tree management system	Villages				Tree species
		MCT	LKM	KSA	UNG	
1	Preserved during jhum cleaning for firewood, bally post, pillars etc. trees were cut down at an average height of 10 -12 ft. during first year jhum they were used as support for climbing vines of various crops and vegetables. Most of the loped trees produces coppices and survive which later become big trees.	P	P	P	P	Macaranga, Trema spp., Meset sung, Schima wallichi, Sungpet sung
2	Exiting big trees of good and valuable species were preserved during the jhum cutting operation by just cutting all the side branches and left. In most cases, the area surrounding the trees is cleaned of twigs and leaves to save from fire during burning the slashed fields.	P	P	P	P	Schima wallichi, Sungpet sung, Hollock, Tita chapa, Gamari, Kokon etc
3	Scared trees : Some trees were believed to be sacred and were never cut down e.g. Tita chapa is believed to be born with life like human. Tsuben was also planted in village sacred places where human head brought by warriors were kept and worshipped war slaves were tied there and tortured	P	P	P	P	Tita chapa, Tsuben, Amok, Banyan
4	Superstition and belief : Big trees were not cut down. It is believed that whoever cut down the big trees does not live long or bad luck happens. Hence, if someone cut the tree, a big stone is kept on the stump and says not to blame nor punishes him.	P	P	P	P	Any large trees

Sl. No	Types of tree management system	Villages				Tree species
		MCT	LKM	KSA	UNG	
5	Worship an d s acrificial pl aces : People us ed to worship an d of fer s acrifice of a nimals i n s elected locations or i n ar eas w here t here w ere bi g s tones, lakes et c. In t hese pl aces any t ype of t rees gr own were nev er f elled. I n due course of t ime t he t rees grown very	P	P	P	P	Banyan, Tsungko, Oak etc.

Sl. No	Types of tree management system	Villages				Tree species
		MCT	LKM	KSA	UNG	
6.	Indigo growing areas : Indigo plant grows only in areas with moist and s hade c anopy. I n ol den day s c lothes w ere dy ed using I ndigo pl ant pr oduct s o i n or der t o pr eserve3 an d maintain i ts r equired h abitat i t w as a c ommon s aying t hat there i s an evil s pirit t hat guar ds t he pl ace an d on ly ol d womenfolk w ere al lowed t o go an d c ollect t he l eaves. Later on it become a mini forest and preserved permanently.	P	P	P	P	--
7	Betel vine plantation: Betel vine grows well in places where there is hot and moist climate and there is plenty of shade canopy. I n order t o m aintain s hade a nd allow t he v ines t o climb, t rees w ere pr eserved an d m aintained as a r eserve forest.	P	P	P	P	Hollock, S ungpet and Khokon
8	Preservation of wild fruit trees : Wild edible fruit trees were not al lowed t o be c ut do wn dur ing harvesting s o as t o preserve the trees. If it is felled, fines were imposed by the village authority	P	P	P	P	Aonla, T angshi, Tsurem, D hona, Acid ber ry, Metiyong, Senjijang, M erlashi, Walnut etc.
9	Use of 'V' sign : If anyone wants to preserve a particular tree species either for his personal or for the clan, community etc. he makes a 'V' shaped mark on t he bark of the tree. Once that sign is marked nobody is allowed to cut that tree without his permission and if violated, a heavy fine is imposed on the offender.	P	P	P	P	Any type of trees species
10	For us e i n c ommunity needs t he v illage au thority selects some t ree s pecies i n any one's l and an d pr eserve. T hese trees m ainly preserved f or m aking l ong drums, v illage ga te doors etc.	P	P	P	P	Tita chapa, Hollock
11 a	Preserved for making specific articles Rice pounding articles	P	P	P	P	Schima w allichi, I ron wood, A longsung, T ita chapa, I ndong, P upang sung.
b	Wooden bed	P	P	P	P	Tsunben, T sungya, Alongmetong, B ombax ciba
c	Spear, Weaving handle	P	P	P	P	Iron wood, Palm tree
d	Wooden plate, sauce pan, wooden utensils and tools	P	P	P	P	Gamari, Jarem
e	Latex for paint and making sticky gum	P	P	P	P	Tsungko, Rubber tree
f	For fishing, two types of tree species were preserved by groups or by village c ommunity. I rrespective of ow nership, v illage aut hority has t he right to preserve these trees for community fishing purpose.	P	P	P	P	Fruits of walnut and leaves of walnut

12	Preserved in steep, rough, rocky and unsuitable areas : Areas where agricultural operations were not possible, tree were left untouched and allowed to grow. These areas became habitat to various tree species and produces a number of mother trees. Sometimes individuals were allowed to plant trees of his choice species which later on becomes his own	P	P	P	P	All type of tree species
13	Trees preserved to observe seasons, weather etc : In olden days some tree species were preserved to observed seasons, weather conditions, sowing time etc. In some cases this practices are still going on.	P	P	P	P	Banyan, Metsu tsuben

Recent practices followed by various village are presented in table 22.

Table 22: Present tree management practices in different villages.

Sl. No.	Types of tree management system	Villages				Tree species
		MCT	LKM	KSA	UNG	
1	Village authority has made resolution not to cut down fruit trees but to preserve it. Violators of this resolution are fine	P	NP	NP	NP	All the wild fruit tree species.
2	Planting of trees and preservation of existing tree species in jhum fields. In some villages where jhum lands are leased out for cultivation the owner of the land instructs to plant trees and also not to cut important trees species during jhum period.	P	P	NP	P	All the value added tree species
3	Preservation of plantation trees : In recent years it has become a mandatory to preserve all plantation trees and fines are imposed to theose who cut down this trees without permission. Also the big trees in the village jurisdiction are marked and preserved for use during community requirements.	P	P	P	P	All the plantation trees.

MCT : Mopungchuket, LKM : Longkhum, KSA : Khensa, UNG : Ungma

P : Practiced, N.P : Not Practiced

Results :

1. The study revealed many valuable practices in the past which was a way of life and culture that managed and preserved many valuable tree species.
2. The study indicates how within a short period of time all the valuable tree species and preserved forests has been destroyed by reckless and random commercial exploitation of forest and created negative impact on environment.
3. It draws light on how the good management practices in the past need to preserve and modify accordingly that suited to our present context and incorporate in the management system.

Conclusion :

1. The traditional tree management system needs more in-depth study and should incorporate in the present management practices.
2. A comprehensive plan of action for management of trees needs to be framed and mass awareness campaign should be initiated to preserve the existing bio-diversity before it is too late.

6.12. Package of practices of Aochisang plant

Introduction:

Aochisang is a perennial climber found growing wildly. In recent years farmers have domesticated the plant in their jhum fields and kitchen gardens. It has now become a very important commercial vegetable crop in Nagaland. The tender climbing stem and young leaves are eaten as vegetables. The plant is mostly grown in acidic soils under sub-temperate climatic conditions and grows best at altitudes ranging from 700 – 1600m above msl. Usually, farmers cultivate the crop in the first year jhum and continues up to the second year and leaves as fallow crop. It has now become a household vegetable item which is very tasty and makes various kinds of delicious culinary items.

Morphology:

It is a dicotyledonous plant. The seeds are medium and more or less oblong in shape. The testa is hard and has many sculpturings on the outer surface. The kernel consists of embryo and endosperm. It has tap root system with root nodules in the secondary and tertiary roots. The stem is modified into woody climbers. The leaves are simple and alternately arranged and lamina is lanceolate in shape. The inflorescence is cymose type.

CULTIVATION:

Method of sowing and spacing:

Seeds are sown in the months of March- April by dippling at a depth of 3-4 cm with spacing 75 x 60 cm. Seedlings are planted in pits of 25 cm x 30 cm size.

Hoeing and weeding:

The first weeding is done after 45 days of sowing followed by earthing up. Subsequent weeding follows depending on the intensity of weeds. In general, 3 weedings are done during the active growing season.

Irrigation:

It is cultivated purely as a rainfed crop. However, during the dry season the plant stops growing but the leaves remain evergreen and if no irrigation is given, many plants die up due to moisture stress, so during the dry season 2-3 times irrigation should be given to survive the plant during the winter period.

Harvesting:

Harvesting for vegetables starts at an early stage when crops attain a height of 60 cm by plucking the tender climber stem with young leaves. As the climbing stem is plucked, more lateral branches are produced from the leaf axils producing more climber stem. Subsequent plucking continues at an interval of 6-7 days and ultimately, the plant forms a bushy canopy giving out more climber stem to be harvested. In total 20-22 times pluckings are done during the active growing period. On an average 1.5 Kgs. of leafy vegetables are produced from a single plant during the season giving a total yield of 30-35 MT per ha.

ECONOMIC NET RETURNS /HA IN ONE YEAR.

No. of plants/ ha……	22,000 Nos.
Average yield/plant/year……	1.5 kgs.
Yield/ha……	33,000 kgs.
Rate/kg……	Rs. 5/-
Income// ha……	Rs. 1,65,000
Total expenditure/year……	Rs. 75,000
Total net return……	Rs. 90,000

CONCLUSION:

Its cultivation has great potential in the state as the agro- climate condition is very suitable for the crop. Farmers can earn a handsome income by cultivating the crop on commercial scale. So far, no particular research work has been done on the crop which requires the attention of researchers and Botanists to upgrade the cultivation techniques because of its commercial importance. The chemistry of its nutritive value too needs to be studied. Its market potential within and outside the state should also be exploited in the near future

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Study on Technology adoption in three districts.(Wokha, Mokokchung, Tuensang.)

District (1)	Av. Jhum cycle (yrs) (2)	Mix cropping in order of preference (3)	Crop rotation (4)	Activities for extension of jhum cycle (5)	Constraints in adoption of improved technology/ innovative technology (6)	Role of village authority in natural resources management. (7)
Mokokchung	8 – 15	Paddy, tapioca, maize, colocassia, ginger, chilli, cucumber, pumpkin, soybean, pyrilla, sesame, cowpea rice bean, tomato	-	Planting of short gestation fruit crops (banana, papaya, passion fruit)	Fragmented Land holding system, extra labour management, wild life menace.	VC holds absolute authority in preserving those natural resources declared as village assets.
Wokha	4 – 8	Paddy, maize, colocassia, chilli, cucumber, cucurbits, rice bean, tomato, brinjal, sesame, pyrilla, soybean.	-	Planting of short gestation fruit crops (banana, papaya, passion fruit)	Fragmented Land holding system, extra labour management, wild life menace.	VC holds absolute authority in preserving those natural resources declared as village assets.
Tuensang	6 – 9	Maize, millets, paddy, colocassia, kholar, yam, soybean, chilli, pyrilla, sesame, cucurbits.	Foxtail millet-maize / kholar-soybean	Planting of alder trees (Noklak area, Chingmi and Kuthur)	Fragmented Land holding system, extra labour management, wild life menace.	VC holds absolute authority in preserving those natural resources declared as village assets.

Av. No of crops. (8)	No. of medicinal and aromatic plants found (9)	Insect pest and disease management (10)	% adoption of new technology (11)	Need for jhum improvement technology (12)	Requirements for technology dissemination (13)	Suggestions. (14)
25 – 30	70	Local control methods are mostly applied and chemicals are applied as last resort.	a. 5 % b. 20 % c. 10 % d. 20 %	Soil depletion, jhum no more sustainable, land pressure, preservation of bio-diversity	Demonstration, training, workshop, exposure trips, farmers exchange visits, field days, mass media, supply of critical inputs	1. From the overall survey, it is strongly suggested that alder based agro forestry system should be taken up in areas where alder trees can be grown. 2. Land shaping should be taken up on top priority basis. In this connection government agencies should take up pilot projects in potential areas for effective implementation of the system.
25 – 30	65	Local control methods are mostly applied and chemicals are applied as last resort.	a. 6 % b. 20 % c. 30 % d. 10 %	Soil depletion, jhum no more sustainable, land pressure, preservation of bio-diversity	Demonstration, training, workshop, exposure trips, farmers exchange visits, field days, mass media, supply of critical inputs	
15 – 20	50	NIL	a. NIL b. 25 % c. 35 % d. 5 %	Soil depletion, jhum no more sustainable, land pressure, preservation of bio-diversity	Demonstration, training, workshop, exposure trips, farmers exchange visits, field days, mass media, supply of critical inputs	

a. Jhum Intensification, b. Fallow Management, c. Soil Conservation, d. Nutrient Management

III. IDENTIFYING OPPORTUNITIES AND STRENGTHENING FARMERS' ABILITY TO MARKET CROPS AND AGRICULTURAL PRODUCTS

Objective: To analyze vertical and horizontal market linkages and institutions in order to identify opportunities to strengthen farmers' ability to market crops and agricultural products.

1. Background

At the village level there was little understanding of the concept of collective action where produces are collected to form a critical mass. In the villages adjoining Assam, especially in the district of Mon the small time traders locally called '*Biparis*' move about in the jhum fields of the farmers and buy the produces in situ. In other cases the farmers themselves bring the goods to the shopkeepers and sell it to them in wholesale. While this system of marketing is adequate when the produce is in limited quantity, in view of up scaling of production due to realisation by the farmers on the increased level of household income there had been surplus production in the villages. It was observed that the traders had taken advantage of the poor farmers who sometimes compete among themselves in the disposal of their produce even as distress sale.

2. Research methodology

The researchers collected information about the village as to the main cash crop that is being cultivated in the project villages by gathering information from different sources such as interviewing the District Agriculture Officers (DAOs), Ditrict Horticulture Officers (DHOs) and District Soil Conservation Officers (DSCOs). These information were supplemented with information from other sources like Statistical Handbook of Nagaland and Nagaland Profile – 2002. Having collected basic information, the research team went to the villages and had group interviews and focussed group discussions with the village elders and farmers and validated the basic data.

In all steps of the data collection, participatory approach tools such as group discussion, indepth interviews and largely direct observations were employed. Since the POU members of the project had already established rapport with the villagers, the team avoided the stage of rapport building with the villagers. The information provided by one section of the people was validated in the next visit from another section of the village.

While undertaking indepth interviews with the villagers, views of the women were considered a very important component of the research undertaken. Their view were sought at informal discussions in the village meeting places, however, in the presence of elderly men they tend to give their agreement even they have other views. Therefore, the team members made it a point to have a separate meeting with the women separately.

3. How villagers were marketing the 'menu crop' products

In order to strengthen marketing activities in the village, understanding the strength and weaknesses of the existing marketing system is necessary. For this purpose, SWOT analysis was carried out in seven villages of seven districts on how the farmers were marketing cardamom, passion fruit, French beans and turmeric.

3.1 Cardamom

3.1.1 Khonoma in the district of Kohima

The growers are able to sell their cardamom by directly contacting the dealers in Dimapur. One of the ways that the grower found a market to sell his product was taking a sample of the cardamom to Dimapur and displaying his product to potential buyer. In this way he talked to

several potential buyers and struck a deal with the trader who offered the best price. As stated above there over 20 growers forming an informal society but when it comes to selling their crop each of them finds his own trader. The main reason being that they are yet to standardise the quality of the product and so the person who produces a high quality product is not willing to compromise the price of his product by mixing it with an inferior product and reduce his selling price. However, in some cases where the quantity of cardamom produced by some growers is too small to find his own trader, the larger producer purchases the fresh capsule from him at mutually agreed terms. The larger producer then processes the raw material at his own standard and sells them to the trader with whom he had struck the deal.

During 2003 some Cardamom growers of Khonoma village numbering about 20 persons are formed an informal society to motivate all farmers in the village to cultivate it. The strategy they are employing at present is to supply planting materials to the children and wives of those who are opposing the cultivation of cardamom. These villagers who are discouraging the cultivation of cardamom in the village are of the opinion that if cardamom is cultivated, there will be no place for cattle and Mithuns to graze. Sato, Ngusie, Seto are the main producers from Khonoma. Among these main growers, Mr. Ngusie sold Cardamom worth Rs.1.00 lakh. They growers were selling @Rs.120/kg in Dimapur in 2003.

In Khonoma village, there is a paradigm shift on cropping pattern from subsistence Alder-based jhum cultivation to cash crop farming where cardamom cultivation has become a 'Village Movement'. The reason for opting for cardamom as the crop of choice of the village was that it is the perfect crop for agro forestry, where farmers can earn money at the same time trees are preserved. While the location of the village has a favourable soil and climate, it is also easy to cultivate and fruit yield continues for many years.

However, this venture is not devoid of apprehensions in the minds of the villagers. The farmers observed that cardamom plants die out in large quantity during dry spells. Planting materials are expensive in the sense that even @Rs.1.50/suckers, the farmer require over 4000 suckers that cost the farmer Rs.6000.00 on plating material alone. The farming family therefore, prefer to extent the area slowly by uprooting the old suckers from the family's plantation and planting them in new areas. Fencing materials are also expensive for farmers to afford. And the worst menace being rodents, who relish on the cardamom capsules during harvest time.

Another concern of the farmers is in the area of processing of the harvested capsules, as artificial drying involves burning huge quantity of firewood which produces smoke and reduces the quality of the capsules. Though NEPED has tried to address this issue by installing an up-draught gasifier, it is not sufficient to cater to the drying needs of all the cardamom growers.

Cardamom is not consumed locally, and thus, it has to be sold in markets outside the State, and farmers are unable to locate suitable outlets that will give good profit margins. Another setback in not attracting good market is insufficient quantity production.

Recommendations for improvements of marketing activities

- Government and other developmental agencies including NEPED should explore marketing avenues and create linkages in order to encourage farmers to earn optimum profit from this venture.
- Since small quantities do not attract market, entrepreneurship needs to be encouraged so that a collection point is established where farmers with small quantities gather their produce and send out huge quantities to the market.
- Improving the communication systems will also go a long way in aiding the farmers in obtaining latest information on market opportunities and prevailing price globally.
- Construction of good field huts will aid farmers in spending more working hours in their fields.

- Providing water reservoirs would also be an added bonus, as during dry spells crops can be watered from such reservoirs.
- Bee rearing in the field can also be encouraged to help cross-pollination of the crop.

3. 1.2 Mohung village in the district of Mon

A study of Cardamom in Mohung village was undertaken to find out how this crop has impacted on the livelihood of the farmers of this village. This village was selected for the study because the farmers have taken up this crop in a large scale, having realized that Cardamom is easily sold and agents come up to the village doorstep for purchasing the whole consignment. Besides, the soil type and climatic condition of the village is ideal for the crop. Planting materials are available in plenty, and motivation of the farmers is at its peak.

The farmers opted for this crop as both Cardamom suckers as well as the capsules could be sold at a good price. This has enabled the villagers to send their children to good private schools. Samlo, a Cardamom farmer could afford to pay his children's school fees in private school through sale of cardamom capsules. Hewang, also a cardamom farmer could earn Rs. 60,000 from sale of the suckers. This only goes to prove that cardamom is a boon for the poor villagers, which has improved their livelihood.

From this study, the weak link in the chain of production at different stages could be identified. Some of them can be summarised as follows. The cardamom harvested is dried in the field itself. The firewood is collected from the nearby forest for drying the cardamom through direct contact with fire and smoke and as result the finished product had blackish appearance and the aroma is not as it should be. The dried capsule still contains more than the standard recommendation because the capsules does not give a cracking on shaking.

In whatever state of dryness of the capsule, traders from Assam come to the village to buy cardamom in the village. The villagers were selling to the traders @Rs.70/kg. The villagers also informed us that some of their villagers had made attempts to collect from the village and transported them by bus to Dimapur where they were able to sell at Rs.80/kg. Most of the farmers take the dried capsule to Aboi Town and sold them @Rs.70 to Rs.75/kg.

Formal or systematic marketing chain is yet to be established although Village Marketing Committee had been constituted as mandated by the Government. In 2005, the Mon district APMC issued an order that all marketing of cardamom product in the district is to be routed through the APMC facilitated by the VMC. Ironically, the price was fixed at Rs.45/kg. Though the producers were reluctant to sell it to APMC, they had no alternative. The traders from Assam did not come to the village to buy the product, neither they were able to sell the traders in Aboi because these traders were reluctant to buy as they were not in a position to transport the goods further to Assam without movement permit, which is issued by the APMC Mon. As a result of this bottleneck created by the local authority, many farmers did harvest their cardamom and left it to rot in the field.

In order to address this problem, NEPED project sponsored two villagers to make a market survey from the nearest trading centre in Assam namely Simulguri and thenonward to Sivasgar and as far as Guwahati. They made a comparative price comparison whether it is a better proposition to sell it in as they do traditionally or to take it out in bulk to Assam. These two villagers were of the view that it made more economic sense to sell their product to the traders than taking their product to Assam by the villagers. This finding was made known to the APMC members. It was reported that in the subsequent year, the APMC did not impose the trading of cardamom on farmers anymore.

Only dried cardamom capsules can be sold in the market. The prevailing process of drying the capsules requires improvement, as they smoke dry the capsules which takes a long time, and huge quantity of firewood is consumed. Improper drying ie; being exposed to direct smoke, reduces the quality of the capsules, thereby, the market value decreases.

The price for cardamom is volatile as it is governed by the price at the national level. The agents who come to the village for purchase refuse to buy the consignment when price at the national level plummets.

Some of the improvement measures that can be adopted in order to generate better income would be to encourage and create awareness amongst the farmers to grow more in order to capture good market and generate more income. The farmers have contacted markets in Guwahati, and have been assured good price; however, transportation of the produce to Guwahati is a big hurdle for the simple villagers. Initial assistance in making transport available would pave the way for a sustainable linkage with the traders in Guwahati.

Another improvement measure would be to have a collection centre for all the farmers produce, as bulk disposal would attract buyers rather than farmers trying to sell individually.

The farmers' perceived threat on cardamom plantation is that if vast tracts of land are put under cardamom plantation, there will be no more land available for poor farmers to jhum. Another threat confronting the villagers is that due to frequent fluctuations in price, farmers may incur loss.

The value addition techniques adopted by the villagers for drying cardamom involves drying over fire, sun drying by spreading the capsules over CGI sheets. Intense heat applied on the capsules makes them crack. Sun drying produces the best quality; however, it takes more time and sunshine is not always constant. Training on drying technique needs to be imparted to the villagers so that quality is maintained and farmers get the best price for their produce.

3.2 Passion fruit

3.2.1 Longsa village in the district of Wokha

In Wokha District, Longsa village was selected for the study where passion fruit cultivation has been a great success, contributing to the income of the villagers. Longsa village is easily accessible owing to its proximity to the District headquarter with good road communication, thereby, transportation for marketing their produce has not been a problem.

There are two ways of selling passion fruit in this village. When the scale of production was small, the villagers were selling them to local vendors who purchase them and retail them at Wokha and Kohima. The producers were getting good price in this form of trading because they were getting about Re.0.75/fruit. This good price had motivated the villagers to go in for putting more areas under Passion fruit cultivation. At a certain point of time there was surplus production, where the local traders were unable to trade all the produce and there was a glut in the village. Recognising this waste, a strategy was formulated by the villagers to involve the village marketing committee to dispose the surplus product. The VMC in turn approached the APMC of Wokha district for the bulk purchase of the Passion from this village. The price which the APMC offered was Rs.7/kg. However, this was not agreeable to the villagers because one Kg contains 32 to 37 fruits. In order to solve this stalemate the NEPED project did two things.

The project team members first undertook production cost analysis with selected Passion fruit growers through participatory approach for the first year of cultivation where it was estimated at Rs.3.01/kg in one case and Rs.4.00/kg in another case. The cost of production in the subsequent years will be reduced because the fixed costs such as planting material, trellis, planting and support pillars will not be added to cost of production. This fact was disseminated to the growers.

The next thing we did was to take the growers, VMC and APMC members for a study and exposure tour to passion fruit processing factories in Dimapur and Longnak of Nagaland, Punanamai of Manipur and Gangtok of Sikkim. In this trip, we did estimation on the cost of processing with the management of the processing factories and found that it costs the factory not less than Rs.65.00 to process 750 ml bottle. The passion fruit growers and VMC members

were convinced that Rs.7/kg was a fair price they were receiving. They also learnt the fact that if the survival of the factory is for their benefit and in order that the factory survives and prosper the price of the raw material had to be reasonable. In this way a symbiotic relationship is established between the growers and the factory.

After this tour the VMC of Longsa village and APMC Wokha were able to negotiate with the factories they visited with NEPED and established a market linkage. The VMC facilitated the sale of passion fruit. They contacted the Horticulture Department for providing truck for transporting the raw material and fixing the dates and times of collection and informed the growers. In this way Longsa villagers were able to market passion fruit produced from the village.

Passion fruit cultivation was first experimented during 1960's with seeds brought from Kohima, and with NEPED providing Revolving Fund to needy farmers wanting to develop Passion fruit farms since 2002, more than 100 farmers have taken up this venture. Due to the enterprising nature of the villagers who grow and sell vegetables and passion fruits in large quantities, buyers from outside were attracted to come to the village. Price of Passion fruit has also been competitively fixed at Rs.7/- a kilogram to attract buyers. However, for mass commercialization of this commodity, support in terms of establishing a sustainable marketing linkage is required.

Government support in terms of planting material and GI wires for trellis of the vine had encouraged the farmers to take up passion fruit farming in a large scale. Cultivation of Passion Fruit is also relatively easy with profuse bearing of fruits.

However, there are also problems associated with this success. They are;

- GI wires as trellis for the vine is not easily available and affordable for the poor farmers.
- Inter cultural operations such as weeding which is necessary during April to July comes during the busiest season for paddy cultivation, thus, sparing labour for weeding operation in passion farms becomes a problem.
- Marketing of the fruit after harvest is also a weak link that the farmers face.
- Quality control is a major challenge for the farmers, as it is not easy to maintain the fresh and attractive colour of the fruit for long.

Lack of marketing avenues has always been a disabling factor, as there are no proper established linkage, infrastructure for bulk storage and transportation to the nearest market. The Government has a big role to play in helping the farmers by providing vehicles for transportation or by providing transport subsidy. An assured market would also be a big boost to the farmers.

The main threat a Passion fruit farmer faces is in the event of hailstones damaging the fruits, which happened during 2004. Insects also bite through the vine at the base thereby, killing the plant eventually.

As part of value addition to the product, farmers wash and clean the fruit to make the colour of the fruit appealing to the buyers. The fruits are also handled gently to minimize damages. Many farmers have purchased juicers for juice extraction.

This study also revealed that that the building used for marketing purpose, needs renovation, and storage facility is urgently required for bulk collection.

3.2.2 Phekerukriema village in the district of Kohima

This village had taken up passion fruit in a substantial scale by the standard of traditional villages. As such the village was selected for the study as the whole village is involved in cultivation of this crop using traditional method with locally available materials. It is also located near Kohima, the district headquarters and is convenient for visitors to see the traditional way of its cultivation.

The villagers had opted for cultivation of this crop owing to its favourable soil type and climatic conditions, and also its easy method of cultivation using locally available materials for fencing. The sale of the fruit also fetches good price for the farmers when the production scale was small and they were able to sell them locally and also the vendors who retail them at Kohima. By seeing the income generated from the sale of passion fruit by fellow villagers, many other villagers also started to cultivate the crop and soon there was a glut in the village and it became a problem that needed to be addressed.

The Project addressed the sale problem by forming and training women self-help-groups into processing passion fruit into juices. This solved the problem only partly because they were producing more than the local needs and the SHGs were not in a position to find a wider market because the product were not ISO marked. Moreover, juice extraction by the farmers is crude and unhygienic therefore, keeping quality is poor.

It was observed that they were left with only two options. One was to link the village product to passion fruit processing factories and the other option was to set up their own primary processing unit at the village. While the second was preferred by the villagers, the village did not have the resources to venture into such project neither did they have the entrepreneurs who could carry it forward. The villagers therefore, decided to venture into the first option. The NEPED project therefore sponsored the growers and SHG members for a visit to the factories in Dimapur of Nagaland and Punanamai of Manipur, both were accessible to them. After this they were able to negotiate their own MoU with the factories and started to sell their product to the factory.

The farmers had observed that there is a gradual decline in fruit bearing after the 3rd and 4th year, size of the fruit also becomes smaller and vine is also prone to pest and insect infestation. There are also unseen threats confronting the farmers of this crop because fruit bearing is affected in the event of heavy rainfall during its flowering.

3.2.3 Ungma village in the district of Mokokchung

This village has good accessibility, being very near to Mokokchung town, the district headquarters and also because about 50 farmers have taken up passion fruit farming in large scale. Farmers of this village had taken up Passion fruit cultivation in a big way due to the realization that this venture may be more profitable than jhum cultivation. The soil type and climatic conditions are favourable for the crop, and once planted, the plant bears fruits for 10-15 years. The farmers also assume that there is high demand for passion fruit in the market, which will eventually generate good income for the farmers.

Longnak fruit canning factory which used to be the main consumer of passion fruit in the past, when production was small refused to buy large quantities owing to financial constraints. This has compelled some farmers to sell their produce at throw away prices. A sustainable market linkage is yet to be established. The growers were taking their product individually to the Factory. Since the Factory has a limited processing capacity and has several villages providing raw material with little arrangement for storage, sometime the producers bring their product to the Factory site just to be rejected resulting in wastage. Part of the product was used for juice extraction manually in the village involving a tedious process, for local consumption only.

While the producers' aspiration had been to set up a processing unit in the village, there are problems of mobilising resources and finding market for the finished product. The most pragmatic solution to this wastage was to find other buyers and not depend only on Longnak Fruit Processing Factory. In order to address this problem, the NEPED project sponsored a study tour for the growers and VMC members to other Factories in Nagaland and Manipur.

In 2004 and 2005, it was observed that the VMCs were actively getting involved in the process of facilitating the sale of passion fruit product by negotiating the selling with the producers and making arrangement for transportation of produces to the Factory sites with the APMC and the

Government

In order to increase the area under its cultivation, the growers were facing the problem of meeting the cost of Barbed Wires, which is for construction of trellis for the vine and fencing the farm. Another interesting finding was that they the family learnt to manage its working members to attend to both passion fruit farm and jhum field. In the past all family members were involved jhum cultivation only. Often some families have a trade off by reducing the area put under jhum cultivation to give more time and afford to passion fruit enterprise. In some cases few families had decided to go for passion fruit and other supporting enterprise like piggery and poultry and gave up a major areas of jhum that are being converted to forest.

3.3 Leangkunger village: Kholar (French beans)

Leangkunger village in Tuensang District has adopted French bean (Kholar) cultivation in a massive scale, generating a lot of income for the farmers. The village has very short jhum cycle and so up scaling the production of Kholar was a better option for the farmers. The villagers having understood their plight of short jhum cycle, they have developed adoptive strategy of cultivating legumes that rejuvenates soil fertility and at the same have demand in the market where they could sell their product and generate income. Since French bean has a soil building character, the villagers had used it in incorporating it into the agriculture system.

Growing legume crops in a fallow land is an additional income from the same piece of land which otherwise, was suppose to have entered fallow period. They go for intercropping with legumes to maintain the soil fertility and take much care to get the maximum produce from that same piece of land for sheer sustainability. Crops like French beans, soybean & rice bean are alternatively rotated every year. In the fourth year the same crop used in the second year is repeated. The yields are reported to be constant throughout the cultivation period. Some farmers had continued to the fifth year in the same plot.

They also had built a marketing linkage around the crop. In the initial years of adopting the strategy of large-scale cultivation of Kholar they had surplus production and much of the produce was being wasted. Some enterprising farming family started to transport the produce in head loads to Tuensang, the district headquarter, and begun to sell them in the market. This process was followed by other farming families and soon it began a common practice for the villagers.

The fact that Leangkonger village is producing Kholar in large quantity became well known. Soon traders from as far as Assam and Dimapur started to come to the village in search of the crop during harvest season to purchase them. The village marketing committee was activated into action by facilitating the sale. The VMC took stock of the production and were able to guide the traders in identifying the farmers who had surplus product and negotiating the deal with the traders. The VMC were able to negotiate with the Armed Forces and made deals with them for supply of Kholar to their mess. The Government of Nagaland also took cognisance of this fact and efforts are being made to get Organic Certification for this particular crop from this village.

The following are the enabling factors that has encouraged Leangkunger villagers to take up Kholar in a big way

- Having better road communication compared to other villages, has been an added advantage for transportation of the harvested crop to markets.
- This crop has a good shelf life, and can easily be stored for 10 months after harvest.
- It is easy to transport as it can be sold in small quantities
- Soil type ideal for Kholar cultivation is found only in this village
- Kholar cultivation unlike other leguminous crops is beneficial for enriching the soil as the roots have nitrogen fixing properties.

Some disabling factors include; scarcity of land resulting in inability of cultivators to cover large areas of land as desired, and also uncertainty in market for large quantity supply. A major problem for the villagers is also the absence of processing and storage facility. The farmers need assistance in marketing their produce outside the district, and Government can assist in establishing market linkage and technical support for sustainable production of the crop. Kholar beans are highly susceptible to pest and rodent infestations and often due to failure to market the same, end up being fodder for pigs.

Kholar beans are easy to handle, and requires little or no value addition except perhaps, proper aeration while storing in bamboo baskets, and of course grading. The villagers require storage facility with proper ventilation.

3.4 Bade village: Turmeric

The study in Dimapur district was made in Bade village owing to large area that was put under cultivation of turmeric, which has been adopted by the whole village and has generated a lot of income for the villagers. This venture has proved so successful; the Agriculture Department has declared the village as "Seed Village" for turmeric. Sandy soil which is suitable for turmeric cultivation is found in the entire Dhansiri valley under Bade village.

Bade is located 20km away from Dimapur with good road communication and as result the farmers were able to contact the traders in Dimapur carrying a sample of their product and displaying them to the traders. The traders in Dimapur having come to know that a large quantity of turmeric had been produced from this village, they came to the village purchased them in bulk during 2003 although the price was @Rs.2/kg which was not satisfactory to the producers. The information that Bade is a turmeric producing village spreaded to other traders so that the subsequent year 2004 traders from Assam came to bid with a higher price and they were able to sell at Rs.4/kg. All these trading had occurred at individual farming family level, although an informal alliance was formed among the growers and information were shared.

Many farmers in Bade village cultivate turmeric because in the opinion of the villagers its cultivation makes the soil fertile. The large and thick foliage of the crop when shed decomposes easily and adds humus themselves come all the way to the village and purchase the whole quantity available. Turmeric can also be inter-grown with crops like Dal and Maize thereby, generating more income for the villagers.

Selecting suitable soil type for turmeric cultivation is important and often some farming families had to bear losses because of wrong selection of site. Farmers find difficulty in differentiating Patni variety in turmeric which is most favoured in the market, from other varieties during collection after harvest. Even though they want to increase the areas under its cultivation, in the absence of modern machinery like tractor and power tillers, farmers had to manually work for field and soil preparation.

Post harvest operation of turmeric require, among others, removing the root from the rhizome, washing the rhizome, boiling it before setting for sun drying are slow and tedious process the farmer had undertake. Finally, sun drying of the boiled turmeric takes a long time as during night time the dew drops adds moisture to the already drying turmeric. Up-draught gasifier which was installed by NEPED dries the turmeric very fast, however, firewood consumption it very expensive.

At present the only value addition being done on turmeric by the farmers is in boiling, sun drying, sorting and grading. The technology on value addition required by the farmers urgently is in large capacity boilers, shelling of the hard skin of dried turmeric, and crushing and powdering technology and machine for dried turmeric.

4. Augmenting marketing of Ginger, Cardamom, Passion fruit and Turmeric in Nagaland

The recommendations of the previous phase of NEPED-IDRC research for planting agricultural crops along with the growing trees that are also marketable were wide range. The recommended crops included both annual and perennial crops such as Cardamom, Passion fruit, Betel vine, Black pepper, Tree tomato, Ginger and Turmeric. During preparation for village micro-plan, these crops were also tendered to the farming community to be cultivated as part of the NEPED activity under establishment of village credit mechanism.

NEPED envisages a transition from subsistence agriculture to market oriented production in Nagaland. This involves processing of agro-forestry products, value addition, establishment of marketing infrastructure for agro-forestry products and establishment of marketing clusters in the project area. The following Table gives a picture of the achievements made during the NEPED project period from 2001 to 2005. Farmers have limited understanding of how market systems work and therefore, awareness of market functions and methods of improving their market returns was initiated by the team.

Table. 1: Area of annual and perennial crops cultivated during the project period from 2001 -2005

(Areas in hectares)

Sl.No.	Name of crops	2001	2002	2003	2004	2005	Total
1	Cardamom	385	610	304	163	255	1717
2	Passion fruit	211	185	88	99	185	768
3	Arecanut	17	104	75	19	40	255
4	Banana	54	91	62	28	65	300
5	Betel vine	100	50	98	38	55	341
6	Black pepper	69	51	30	22	40	212
7	Pineapple	7	42		13	93	155
8	Orange	10	5		37	82	134
9	Tea plantation	293	33	34	29	50	439
10	Ginger	59	564	118	138	295	1174
11	Oilseed	40	17	8	4	15	84
12	Maize	32	46	88	9	15	190
13	Soybean	13	32	29	16	30	120
14	Turmeric	8	20	11	27.5	40	106.5
15	Potato	6		9	17	100	132
16	Others	49	67	129	48	84	377
	Total	1353	1917	1083	707.5	1444	6504.5

Cardamom is emerging as the main crop of the project. A total area of 1717ha has been cultivated. Harvesting of cardamom had begun in 2003 from project villages. This was followed by Ginger covering an area of 1174ha. Passion fruit cultivation was in the third position when the second phase of NEPED was in operation, with the emerging market potentials for this crop there had been increased in the area under its cultivation. Although Turmeric was not found to be among the most important crops cultivated by the NEPED farmers, because of its ease in the cultivation neighbouring villages are increasing its areas.

The above crops have been selected for more in-depth study because they have better potentials for market. In general farmers have opted these crops mainly because of the following reasons:

- They have been cultivating the crops and generating cash income, albeit in small scale. Thus, it was only a case of up-scaling what they have been cultivating
- The shelf life is manageable
- There traders who buy them on wholesale.
- Excepting Cardamom and Turmeric, farmers are able to retail sale them in local markets

- The crops are not cost intensive and can be grown in the home gardens and also along with their jhum cultivation

An overview of marketing status of each these crops are discussed below.

4.1 Ginger

4.1.1 *Production, pricing and promotion*

a. Production

Most gingers productions are from Jhum fields. Farmers plant their ginger in rows along the contour lines where they have placed tree poles to check soil erosions. In some cases they have also cultivated the crop as a pure cropping, though these types of productions are not common.

Farmers plant seed ginger along with other normal jhum crops during the months of February and March. Weeding operations are given as usual with other crops. Thus, the cost of production is reduced since they do not have to give in extra effort for its cultivation. However, the yield per hectare is minimised and cost benefit analysis is too complex because one has to take into account other twenty or so other crops that are cultivated. The main crop in jhum is rice and ginger is considered one of the subsidiary crops. Harvest starts by December and continues till its peak season in February

There are mainly three varieties of ginger that are being sold by farmers in the market. Two of them are local varieties and the third had been introduced.

i. Fibrous and pungent variety.

This is the smallest of all the three and most favoured one among the local Naga consumers. The price is much higher selling in packets of about ½kg costing Rs.10/per packet. However, in terms of export wholesale, it fetches the lowest price as compared to the other two.

This variety, being highly pungent and aromatic, the essential oil content may be higher than that of the other verities of ginger. It is therefore, may be worthwhile to find out the essential oil content and tie-up with an appropriate firm for sustained market linkages. Should this be made possible, farmers of Nagaland will be benefited immensely. Farmers know more about how to cultivate this variety than the Giant/*Nadiya* variety, because they have been cultivating this crop for many generations.

ii. Medium fibre variety.

This variety is slightly larger than the previous one and has less fibre content. It is also less pungent and aromatic. The local people have less preference to this variety as compared to the first one and therefore are not in high demand in the local market. However, there is demand for this local variety at the national market although the price is not as good as the Giant/*Nadiya* variety.

According to the farmers the above two varieties mentioned above are resistant to pests and diseases.

iii. Giant/Nadiya variety

This variety was introduced recently from outside the State of Nagaland, perhaps through Government extension programme. It is fibreless and gives a high yield. The area put under cultivation of this variety are all for commercial purpose and only occasionally for household consumption when fibrous variety is not available. People in Nagaland do not prefer this variety and therefore, is not in demand in local market.

NEPED project team members accounted the production of ginger during 2002 to be about 360MT that was purchased by one Delhi based traders who temporarily stationed at Dimapur and purchased the product. The NEPED project team members made this particular arrangement of marketing ginger. There had been other Dimapur based traders who were also purchasing ginger in Dimapur which the NEPED team members are not in a position to

estimate the quantity sold.

This particular variety, though fetches better price in wholesale, is susceptible to pest and diseases. The question arises, if chemical pesticides were to be used to control pests, the status of organic product would be lost and the price would plummet. On the other, should the pest and disease crosses the threshold level without the use of chemical to control them the yield would plummet. Thus the issue arises, could we find a striking balance? Perhaps lesson could be learned, from Seed Selection by Women, as to how to select disease materials.

b. Pricing and Promotion

During late 1990s traders have been coming to villages to buy ginger @Rs.8/kg and offering as high as Rs.10/kg at villages. This had motivated the farmers even in remote villages to put in more areas under ginger cultivation. Noticing the interests that farmers are putting in the cultivation of ginger, several Government programmes promoted the cultivation. Farmers of NEPED villages also showed keen interest in its cultivation.

During 2002 an informal contract was drawn by NEPED with a Delhi based trader @Rs.4.50p per kg in the month of February. Incidentally, during this period we were informed by the Spice Board of India that the price of ginger in Guwahati had crushed to as low as Rs.1.75p per kg (telephonic conversation with Officials of Spice Board of India, Guwahati). Farmers themselves started to bring their product and negotiated the price with the trader. Later the price started to rise to as high as Rs.6/kg. It was clear that if the farmers were to pay for the transport cost they would hardly be able to cover even the cost of cultivation and post harvest operations, much less making a profit. Therefore, the NEPED project assisted the farmers in covering the cost of transport up to Dimapur.

In 2003 April, a Kalkota based trader ARICHA TRADING CO. LTD offered Rs.14/kg at Guwahati, with the condition that; the consignment of 20MT reaches Guwahati within one week and each clump weigh not less than 250 gram. The price of ginger at this point of time in Imphal, Manipur was Rs.4.50/kg and Guwahati was as low as Rs.2.50/kg. The trader branded ginger from Nagaland as 'Dimapur Ginger' for reasons best known to them. Also, Dr. Mihir Maitra, ICEF Project Manager informed about ginger in New Delhi being retailed under a brand name Dimapur Ginger. Traders were purchasing @Rs.8/- to Rs.10/kg at Dimapur

How ginger produced from Nagaland fetching a better price than the neighbouring States? One possible answer is that ginger production in Nagaland is all organic by 'default', if it was organic product that was the key factor for fetching a better price, is the products being fairly paid or under paid? Is there any possibility of taking advantage of the brand name 'Dimapur Ginger', promote it through sustained supply that would result in increased income of farmers through increased production and also derive a better price. How to organise a market network at various levels so that sufficient quantity was available to trading houses and quality desired.

c. Market scenario can be seen by the three case examples as follows:

i. Punglwa village is located at about 30km away from Dimapur. The village had become quite popular for its production of ginger during the year 2002. In this village there are five collectors who are producers also. They collect from fellow farmers at a slightly lower price and add to their production and they are sold to the traders at Dimapur. The village is near Dimapur and therefore the transportation posses a minimal problem. The profit level is about 0.50p per kg.

ii. Chare village is in Tuensang district. It is located at about 450km away from Dimapur. The hiring charge of a Truck is not less than Rs.15000/- per trip. All the inhabitants of the village have cultivated ginger during 2001 under NEPED Project. In this village, the Village Development Board took the initiative, collected the

produce and brought down to Dimapur for sale. The selling price is the same as those that were brought from Punglwa village

iii. The scenario in Chizami and Chazuba villages of Phek district was that the farmers harvested their ginger, which was collected by the VDB in case of Chizami and VMC in case of Chazuba.

In view of the fall in the price of ginger during 2002, many farmers were discouraged and discontinued its cultivation. However, those who persisted are anticipating good price during 2004 because several traders have come to Kohima to negotiate its purchases. True to the expectation of those who persisted, the selling price rose. The farmers were selling at as high as Rs.25/kg although in most cases it was Rs.18/kg. The price remained more or less stable during 2005 and 2006 with an average price of Rs.15 to Rs.20/kg.

NEPED project had played a major role in ushering in ginger marketing into Nagaland. The farmers were finding their own market to sell their produces without assistance.

4.1.2 Lessons learnt from Ginger market flop in 2007 in Nagaland

Encouraged by the good price for a consecutive two years, the Government of Nagaland as part of its policy for commercialisation of agricultural produces distributed planting materials to farmers for production in commercial scale in 2006. In this distribution, ginger rhizome was the major item. It was expected that production of ginger at 1:5 ratio of harvest would be 30,000MT. However, the price of ginger plummeted from as high as Rs.15 to 20/kg in 2006 to as low as Rs.7.50/kg well graded ginger in 2007. According to the Chairman, Agriculture Produce Market Committee (APMC), Kohima, the major cause of low price of ginger was due to the Chinese influence on its market at a very low cost. According to the Chairman, in the past few years, Bangladesh had been a major buyer of Indian ginger especially from the NE region from where it is re-exported to Pakistan and then to the middle-east countries, this door was closed due to the Chinese influence in its market. Even at the rate of Rs.7.50/kg graded ginger, supply was much more than the demand. It was reported that there was surplus product in other places like Bangalore, Cochin and neighbouring states of Arunachal Pradesh, Upper Assam and Meghalaya, which had influenced the main national market.

In this scenario of supply and demand, it was no wonder that even in January 2007 no traders from the mainland were coming to Nagaland to buy ginger. There was immense pressure from the producers on the Government to buy back the harvest from the planting material that it had distributed.

Following this pressure a Memorandum of Understanding was signed between the Government of Nagaland and Agriculture Produce Market Committee (APMC) of Kohima where the APMC Kohima was to facilitate the sale of ginger @Rs.7.50 graded ginger with strict term and conditions. This arrangement did not solve the problem of marketing the product. One of the reasons was uncontrollable in-flow of stocks from all over Nagaland with the expectation of Rs.7.50/kg regardless of the quality and variety of ginger, the presumption that the purchase was by the Government and that the farmers had every right to dump their product and receive Rs.7.50/kg. No amount of explanation from the APMC Kohima could bring the in-flow into order. The Chairman APMC Kohima said: "we found ginger, mixed-up ginger, baked or suffocated ginger, ginger mixed with yam and other wild tubers, mud and soil mixed ginger, etc, some of which were not even fit for human consumption." In those places where NEPED project staff had imparted training on post harvest handling of the crop, the APMC found it to be more in order where they could send the consignment directly to the destination, Delhi.

To sum up the Ginger Fiasco in 2007, the cause and effect as summarised by the APMC Kohima are:

Business Factor	Reasons
Low market	Surplus production in many areas, making supply higher than the demand in the market No export due to Chinese dominance in many markets with low price especially in Bangladesh – N.E.'s main market outlet
High selling cost	High transportation cost due to poor road condition and difficult terrain in Nagaland High labour cost in sorting and grading to consign Uncalled for taxations specific to the State of Nagaland
High rate of loss in transit	Unsorted, non-graded and unclean goods resulting in taking more and money to get ready for sell Distant from main market Comparatively higher moisture content
(Source: Vilazhu Seyie, Chairman APMC, Kohima, Sunday July 29, 2007 Eastern Mirror, Dimapur)	

In order to avoid such debacles in future, the Chairman APMC Kohima had suggested the following steps need to be taken:

a. Setting up a central store or auction house equipped with modern facilities and basic amenities such as water, power, drying units, Weigh Bridge, market information system, display boards, etc.

b. Management of the store by professionals or experienced people, but not by Government servants

c. Strict business terms applied to suppliers and farmers

d. Creating of a good Bill Discounting facility or a good Credit System (only for the store) supported by the Government.

4.2. Cardamom

General decline of the jhum cycle has become a threat to the ecology, biodiversity and economy of the people in the State of Nagaland and as such it is a matter of grave concern. While planting trees in jhum fields has caught the imagination of the people in Nagaland and has achieved this objective to some extend, the long gestation period of trees compels one to look for additional shorter duration cash crop for fallow management that also fetches cash income to the hill farmers.

Difficult terrain, remoteness and lack of transport infrastructure are the main constraints as to why villages in Nagaland have not been able to move ahead in production of industrial raw materials or establish cottage industries. Thus, the need to identify low volume, minimum labour requirement, high value and good keeping quality crops are called for, where a villager can transport a fortune on a head load to the nearest collecting centre for sale. One such cash crop that suits the site conditions of many villages that farmers can grow in Nagaland is Cardamom.

The Government of Nagaland, during the late 1980s and early 1990s, introduced Large Cardamom (*Ammomum subalatum*) as a cash crop to bring about a transition from subsistence agriculture to market oriented economy, thus to reduce or contain the area put under jhum cultivation. However, this strategy met with only a partial success because the infrastructure for post harvest operations including 'curing' and market linkages were not provided. Despite this lack of infrastructure, some farmers in the villages persisted in the production of the cash crop that attracted the attention of traders who came to buy the produce from farmers in the villages and collecting centres. During 1996 the traders were paying Rs.20 to Rs.30 for one kilogram of dried cardamom, but in the recent years the price per kg ranges from Rs.70 to as much as Rs.150/kg.

Having encouraged by the potentials that exists in the sale of cardamom, farmers in the villages have started growing cardamom earnestly, though at different scales. As a result there was been a sharp rise in the demand for cardamom suckers as planting materials. Existing cardamom farmers have reported that their production have fallen because much of their plants had to be removed and sold as planting materials to fellow villagers. During 2001 the NEPED project was compelled to import 7 lakh suckers from Sikkim because the project holders demanded them for planting in their field.

a. Production

The total area under cardamom plantation starting in 2000 is estimated at about 5450 hectares including plantation programmes promoted by the Departments of Agriculture – 4600ha, Horticulture – 300ha, Wastelands Development – 250ha and NEPED Project – 300ha. It is estimated that more than 2000 hectare will begin to bear fruit by 2004.

The Table below gives an indication that the yield per unit area in Nagaland is at least two times more than the average yield of Sikkim of 262Kg. Thus the potential for promoting the crop was worthwhile. Taking the examples of the case study and the discussion with cardamom farmers it can be inferred that the average yield of cardamom in Nagaland is three times more than the national average.

a. Pricing

In Nagaland, cardamom production in commercial scale is a very recent activity; as a result the selling price is not uniform. Traders who come to buy from the farmers are small-scale traders.

Some collection centres and pricing of cardamom (large) within Nagaland

District	Collecting Centres	Source NEPED project villages	Price Rs/kg during Sept 3 & Oct 2003	
			Dried	Fresh
Mon	Aboi	Mohung, Ngangching	70 to 80	
Mon	Mon	Goching	70 to 80	
Phek	Pfutsero	Phalami, Sakraba, Poruba, Lekromi, Kami,	80 to 90	10
Phek	Chazouba	Yoruba		
Zunheboto	Sapotimi	Sapotimi	70 to 80	
Zunheboto	Dimapur	Other 13 villages		

District	Collecting Centres	Source NEPED project villages	Price Rs/kg during Sept 3 & Oct 2003	
			Dried	Fresh
Kohima	Dimapur	Khonoma, Viswema		

It had been reported by the POU members in-charge of Zunheboto district that Sapotimi farmers had harvested and dried 5MT of cardamom. They have sold out about 1.5MT @Rs.100/kg. Considering the price in Gangtok, Rs.120/kg on 10.05.2003 (Spice Board of India Website) at the village is a good price, therefore, there is need to find out why the farmers are not willing to sell the product

Enabling factors

- Farmers did not report any difficulty in the sale of the product in regards to this crop.
- Cardamom thrives well at the medium to high elevation under primary forests or growing trees. The crop does well underneath many tree species, such as *Alnus nepalensis, Gmelina arborea, Mecaranga* spp., *Melia composita, Spondias axilaris* etc. These tree species are among the top ten species of trees planted during NEPED phase –I. However, it did not do well underneath *Tectona grandis*.
- Management is comparatively easy. Recommended weeding is only three times per year and this can be by the members of the household
- The gestation period is shorter than other perennial cash crop like coffee, tea, and Arecanut. In several villages (Mohung, Ngangching, Pholami) 2001 and 2002 plantations have started to bear fruit and farmers have begun to earn cash income from them
- Capital investment is less than that of many other perennial cash crops. The only heavy investment is in the purchase of planting material. The rest of the inputs are mostly in the form of manual labour which farming family are able to give.

Constraints

- Disconcerting trends in the market price is to drop in the price of Cardamom from Rs.150/kg (14.12.2002) to Rs.103.75/kg (13.12.2003) in Gangtok (Source: Spice Board of India website). The Board attribute this to the reduced volume in the export that had fallen from 1645 MTs last year 2002 to 1250 MTs during the current, due to rise in the Indian Rupee value and fall in US Dollar (EX-IMPO Action Bulletin 27th June to 10th July, 2003). Information were also received that cardamom in being imported from Kampuchea in large quantity by India (Pers. comm. Jamir, Alemtemshi, APC Nagaland, 2003).
- Unconfirmed reports are being received that other Northeast States like Arunachal Pradesh and Manipur are also beginning to produce cardamom. When all these States begin to produce cardamom then a stiff competition for sale of cardamom is likely to take place. This would cause a situation where price would plummet because of glut that would result in a big loss to growers.
- Harvest of cardamom starts in the month of late August and continues till early November that coincides with the late monsoon and harvest season for rice. Cost of curing of cardamom is cheapest when sun dried, but this takes time and also is hampered by the monsoon. Curing by traditional way of smoking decreases the quality and also a huge quantity of firewood is utilised, which is not eco-friendly.

Research need

- Assessment for international demands of cardamom and explore the market potential linkages to such market. This need was raised because in 2007, one farmer sent a consignment to a Firm in Guwahati. The farmers came to know that this consignment was exported to Egypt.
- Developing cost effective means of curing cardamom

4.3. Passion Fruit

Passion fruit, commonly known as '*Bel*' in many parts of Nagaland, is grown in many home gardens in the villages as well as in towns and cities. No one had done any work on how passion fruit came into Nagaland. Its cultivation has attained great importance, and the crop is considered relatively disease-free and easily managed as of now. Farmers grow passion fruit mainly for leaves as vegetable and its edible fruit. Slowly, because of its demand in the market, it started to gain momentum and is now is one of the main occupations of many farmers especially, in Wokha district followed by Zunheboto, Phek, Mokokchung and Kohima districts.

a. Production

The farmers perceive passion fruit cultivation to be remunerative activity. The cost benefit ratio worked out by one farmer (Yankhomo, 2003) in Wokha district is 1:3.31 for 200 numbers of plants in an area of about 0.5ha. Another case study with a farmer (Ponao-Hezhuli, 2003) revealed that the cost benefit ratio is 1:2.

Another reason as to why the crop is gaining its popularity is because of its short gestation period. In NEPED Agroforestry demonstration plot the farmer who had planted passion fruit in 2001 was able to harvest 12MT in 2003.

b. Pricing and distribution

During the fruiting season 2003, the largest consumers were Nagaland Industrial Product (NIP) Dimapur, Fruit Processing and Factory, Longnak. The Department of Horticulture, Nagaland, fixed the buying price @Rs.10/kg some time at the early part of 2000. The price stayed at that for a few years even though the two main consumers were running at a loss, because they are Government Industries. During 2003, the buying price was lowered to Rs.7/kg at farm price but gate price remained at Rs.10/kg, State Government subsidised the transportation to the consumers.

During a market survey trip with farmers and Agriculture Market Produce Committee (APMC) members conducted it was found that a Passion fruit processing factory could be sustained only if the gate price is fixed at not more than Rs.7/kg. However, in order to boost farmers into bulk production, the farm price was fixed at Rs.10/- by the Department of Horticulture, Nagaland.

Market research of Passion fruit that the ultimate potential for consumption of the production in Nagaland is as follows:

Name of Consumer	Location	Maximum Consumption Capacity in MT per year
Nagaland Industrial Product	Dimapur	850
Fruit Processing an Canning Factory	Longnak	250
Passion Fruit Processing Factory	Pudunamai	2000
Total		3000

(Source: direct observation and informal discussion with management by Project team members, 2003)

A substantial quantity is being sold to small-scale processing units that are established in Wokha and Pfutsero. These two units send out the semi-finished product to a processing plant in Sikkim, it was reported. Other produces are sold on retail by vendors in Kohima and other Towns.

If there had been any quantity of product that is being sent out of Nagaland in the form of fresh fruit, it is not noticed during the course of this research, except isolated cases where *Marwaris* came to buy from Longsa village (per comm. Vizo, 2004)

During 2003, the Government of Nagaland made a concerted effort to market farmers' product and feed the NIP in Dimapur. Various Government Department officials were put to task. The following facts were reported from Wasteland Development Department officials (pers. commn. Mich, Neise, 2003)

- farmers packed their product in jute bags in large quantity which resulted in spoilage during transporting and collecting. Those that were packed in cement bags were in better condition,
- farmers harvested fruits long before transportation which resulted in over-ripening and spoilage on arrival and were rejected by the buyers. Whereas those that arrive from Wokha were fresh and in good condition. The farmers of Wokha district were able to do this because the APMC members
    - were able to co-ordinate and facilitate the transportation of fruits with the farmers to sell their produce.
    - instruct farmers how to pack the fruits
    - provided transportation through Government Department at appointed time where farmers were ready with their product

  It was also reported that in some packages stone pebbles were also discovered.

4.4. Turmeric

This crop was selected because the farmers of Bade village, Dimapur district, were able to show to other villages, the benefit of growing one common crop by the whole village community. Qhutovi, who is POU in-charge of Dimapur district reports:

Turmeric cultivation (Yellow gold)

Bade, a NEPED project village under Dimapur district for the first time took up turmeric cultivation involving the whole village In 2002 they could harvest about 47 MT and earned Rs. 1,22,562/- from the sale. Again in 2003 total harvest increased to 105 MT and earned an income of Rs, 2,79,042. It may be mentioned that in the first year the villagers had problem selling the produce. Since this was their first venture. But, by the second year, there was stiff competition among vendors to purchase turmeric from this village. As a result the price increased from Rs. 2.00 to Rs. 3.50 / Kg raw and from Rs. 15.00 to Rs. 17.00 / Kg after drying. A new trend on Agro-based business has been established. Recovery of Revolving Fund from this village is also 100% in terms of interest as well as principal. Now villagers are calling turmeric '*Yellow gold*'

4.5. Pineapple

The main pineapple producing villages in Nagaland are Medziphema and Pherima. In these two villages the main cash-generating source is from the cultivation of pineapple. Most of the product is sold along Dimapur – Kohima roadside (NH 39). It was observed that the cost of one fruit is retailed at Rs.10/- for smaller ones and Rs.20/- for larger ones. When a buyer is to buy three fruits at a time the vendor would part three fruits for the price of two.

Direct observation and informal discussion with vendors revealed that most of them are retailers but there are also producers who themselves are retailing their own product. The average number of fruit sold by 20 to 30 vendors is about 100 to 120. It was observed that in one day a vendor is able to sell Rs.500/- to Rs.600/- worth of goods.

The NIP Dimapur also buys from fruit from the vendors. On one hand, the NIP management informed that they do not get sufficient quantity of pineapple at competitive price from the farmers. While the vendors, on the hand, expressed their willingness to sell their produce in bulk, should they get reasonable price. At this initial stage of data collection, it is not possible to surmise the reason of this discrepancy.

Box: Successful Trial Run in Establishment of Cardamom Market Linkage

Literature and web search into cardamom trading almost always started with Sikkim and ended wit Sikkim. For this reason, the project conducted an exposure trip for cardamom growers of Nagaland to Sikkim where farmer to farmer took place facilitated by the NEPED team members and Officials of the Government of Sikkim. Most of the farmers came back enriched and started to expand the area under cardamom cultivation more confidently. However when it comes to marketing, it was felt that the Nagaland farmers were yet to establish a sustainable market linkage like their counterpart in Sikkim. In Sikkim, cardamom had been cultivated for several generations and the trade linkages had been established so that the relationship between the traders and the producers was on a permanent basis like a regular customer of a grocery shop. Nagaland farmers are still a long way off from establishing such a relationship with traders.

While contracting a consultant to study the market chain has its own advantage in recommending ways and means of enhancing market linkages, they are long term solutions and require a prolonged period of time to bring to fruition. Therefore, it was considered more appropriate to support a local trader to venture into the market as an entrepreneur employing the principle of 'learning by doing'. The experiences gained by the entrepreneur would be shared among the growers. The project identified one such woman entrepreneur and supported her to venture into cardamom trading by giving her an initial support in the form of seed capital. With the seed capital she was able to collect the cardamom product from the neighbouring villages and sold them to traders in Dimapur. Later on she was able to establish market link with traders from outside Nagaland. In this way this entrepreneur not only made a living but also was able to help farmers by purchasing the produces, that otherwise would have been wasted.

5. Assessment of production cost

The expectation for the price of the farmers' produce in many cases was very high. In order to maintain a sustainable market linkage where the buyer and the producers end up in a win-win situation, the farmers had to be aware of the cost of production of their product. In order to let the farmer realise the cost of production, Participatory Rural Analysis (PRA) tool was employed to solicit information from the farmers in their field, in-depth interview with key informants and direct observation by the researchers themselves. In the following passage, the cost of production for Ginger, Cardamom, Passion fruit and Turmeric are indicate

5.1 Ginger

Sl. No.	Item of work	Unit	Quantity	Rate (Rs)	Total in (Rs)
a. Production cost					
1	Plot clearing and burning cost	Mandays	20	80	1600
2	Seed s licing a nd t reatment cost	Mandays	10	80	800
3	Seed cost	Kg	625	15	9375
4	Transportations c ost of s eed to the plot	Kg	625	1	625
5	Ploughing and seed sowing	Mandays	30	80	2400
6	Weeding s oil l ayering c ost t ill harvest	Mandays	45	80	3600
7	Harvesting cost	Mandays	30	80	2400
	Total				20800
b. Transportation cost					
8	Siding to approach road	Kg	8450	0.5	4225
9	Transportation cost to village	Kg	170	25	
10	Cost of gunny bags f or packing	Bag	170	6	1020
11	Transportation c ost, g ate taxes etc. to Dimapur	Gunny bags	8450	0.5	4225
	Total				9470
	Grant Total (a+b)				30270
	Harvest in Kg	8450.00			
	Cost of production Rs./Kg	2.50			

5.2 Cardamom

5.2.1 Estimated cost and Benefit analysis of Cardamom: A Case study of Runguzu village

Description	Unit	Quantity	Rate	Amount
A. Cultivation				
Jungle clearing	Mandays	20	70	1400
Pitting (4500pits a person digs 100)	Mandays	45	70	3150
Planting (4500pits a person plants 150)	Mandays	30	70	2100
Weeding (three times a year 15 mandays per weeding)	Mandays	45	70	3150
Cost of suckers	Number	5000	2.5	12500
Harvesting (a person harvest 80 clumps/day 3150 clumps 70%)	Mandays	40	80	3200
Curing				

Firewood	Stack	4	600	2400
Labour charge (3150*2/400*1.5)	Mandays	24	80	1920
Total				29820
B. Yield estimate				
Average yield from one clump in the first year of harvest = 1 kgs				
Number of clumps fruiting = 3150 (70% of 4500 clumps)				
Total quantity harvested = 3150 = 3150 kg fresh				
Fresh:dry ratio 1:5 = 3150/5 = 650 kg dried				
C. Estimated sale proceed	Kg	650	80	52000
D. Estimated profit Rs. (52000-29800) = Rs.22200/-				

(Source: POU field data collected from informal group discussion with farmers, 2003)

First year cost of production per kg dried cardamom Rs. 29800/650 = Rs.45.00/kg

Second year and onward cost of production Rs.10670/650 = Rs.16.40/kg

5.2.2 Case Study by direct observation at Enhulumi village

Methodology

- A cardamom farmer was identified who was well known by the village community
- All the clumps that produced fruit during 2003 were identified and counted. Clumps that produced fruit were easily identified because the pedicels were still attached to the stems
- After the field visit, through an informal discussion the yield obtained from those plants that had produced fruits.
    - Number of plants that had produced fruit were 1214
    - Weight of fresh capsule obtained was 1557 kgs
    - Dry weight of the 1557 was about 310 kg

When this survey was conducted the farmer had not yet sold the product.

The ideal plant population in one hectare is 4500. This would mean that the yield per hectare is about 3.7 times the yield indicated above making it to 1150kgs of dried capsule. The surveyed field was well maintained.

In another discussion with a cardamom farmer from Wokha district we found that the farmer was confident that in a well maintained plantation area the yield is about 1000kg dried capsule in others 500kgs (pers. comm. Lotha, E.H., 2004).

From the above data, it may be assumed that the yield per clump is 1kg fresh weight. The recommended plant population per hectare is 4000 to 4500 clumps. Thus, in a full potential bearing one hectare may give 4000 to 4500kgs fresh capsule or 720 to 800kgs per hectare.

5.2.3 Oral informal discussion on production cost and yield of cardamom in Sapotimi village

Methodology: Group discussion with village elders in Sapotimi village

Cost benefit analysis of cardamom cultivation Sapotimi village
Approximate expenditure for 1 Ha cultivation @ 5000suckers/ha

Cost of cultivation

Cost of sucker	Year –1 maintenance	Year –2 maintenance	Year –3 maintenance	Year –4 maintenance
Rs.2/sucker	70mdx2xRs50	70mdx2xRs50	20mdx2x50	20mdx2x50
Rs.10,000	Rs.7000	Rs.7000	Rs.5000	Rs.5000

Selling price was Rs140/kg

Year-3 Harvest	Year-4 Harvest
300 Kgs	500 kgs

(Source: data collected by Ghukhuyi, 2003)

From the above Table, the following inference could be drawn:

a. Total establishment cost and its maintenance till the Year – 3 = Rs. 26000.00
Yield in the Year – 3 (dried capsule) 300 Kg.
The cost of production per kg 26000 / 300 = Rs. 87/Kg

b. Maintenance cost from Year-4 onward = Rs. 7000.00
Yield in the Year – 4 onward (dried capsule) 500 Kg.
The cost of production per kg 7000 / 500 = Rs.14/Kg

5.3 Passion fruit

5.3.1. Case study from 200 plants (Yankhomo, Wokha)

a. Estimated cost of production in year – I

1. Cost of saplings (200nos @ Rs 2/-) = Rs. 400.00
2. Post (400 nos @ Rs 20) = Rs.8000.00
3. Barbed wire (7 rolls @ Rs. 28/kgx45kg) =Rs. 8820.00
4. Labour cost (20mandays for 6 months @ Rs. 75) = Rs.9000.00
5. Labour shed = Rs. 10000.00

Total Rs. 36,220.00

(Wages in village: Male- Rs.90/day and Female- Rs.60/day

Harvest

Harvest season	Qty	Rate	Amount
1st harvest (Jun-Aug)	8MT	@ Rs.10/kg	= Rs. 80,000.00
2nd Harvest (Oct-Dec)	4MT	@ Rs.10/kg	= Rs. 40,000.00
Total	12 MT		Rs. 1,20,000.00

a. First year Rs.36220/12000kg = Rs.3.01/kg
Cost Benefit ratio Rs.120000/Rs.36220 = 1:3.31

b. Estimated cost of production in year – II onward:

1. Cost of saplings (25nos @ Rs 2/-) and replacement = Rs.1000.00
2. Labour cost (20 mandays for 6 months @ Rs 75) = Rs.9000.00

Total Rs.10,000.00

Harvest

Harvest season	Qty	Rate	Amount
1st harvest (Jun-Aug)	10MT	@ Rs.8/kg	= Rs.80,000.00
2nd Harvest (Oct-Dec)	5MT	@ Rs.8/kg	= Rs. 40,000.00
Total	15 MT		Rs. 1,20,000.00

Cost Benefit ratio Rs.120,000/10,000 = 1:12

5.3.2. Case study from 1000 plants (Ponao-Hezhuli, Wokha)

A. Production:

1. Cost of Barbed wire & labour = Rs. 5000.00
2. Labour cost (20mandays for 6 months @ Rs 125) = Rs.15000.00

Total Rs. 20,000.00

B. Yield: Harvested 2 Nissan loads = 5MT @ Rs 8/kg = Rs 40,000.00

First year: Cost of production per kg = Rs.20000/5000kg = Rs.4/kg
Cost Benefit ratio Rs.40000/Rs.20000 = 1:2
Second Yr: Cost of production per kg = Rs.15000/5000kg = Rs.3/kg
Cost Benefit ratio Rs.40000/Rs.15000 = 1:2.66

(Wages in village (Male-100-150 & Female- 55) = Rs 125/manday (Male)

Important facts provided by the farmer on cultivating passion fruit

- Each vine yielded 10kg
- Depending on the size of fruit 1 kg contained 30-35 fruits
- 1 *Khan* (basket) of Passion fruit produces 3 bottles pure juice
- In 1985 PF was sold @ Re 0.5 per fruit
- There were 5-8 flushes /plant per year but the best yield was the flush that occur in Jul-Aug of the 3rd year)

(Source: Case study conducted by Vizonyu Liezietsu, POU in-charge Wokha)

5.3.3. Case study of Phekerukriema village (2003)

Cost of Cultivation for 1 Hectare

1. Slash 30 mandays @Rs 80/- Per person = Rs.2560.00
2. Burning and clearing for 50 mandays @ Rs 80/day = Rs.4000.00
3. Digging @ Rs.2/pit = Rs.1300.00
4. Cost of planting material @Re.2/Sapling = Rs.1300.00
   Row to row and Plant to plant : - 15 ft
5. Weeding and harvest 45 mandays = Rs.3600.00

Total cost Rs.13250/-

6. Total Harvest : - Kgs.3000 (Harvested 3 times)
7. Selling Price : - Rs.10/- per Kg (Kohima local market)

Total cash return Rs (3000 X 10) = Rs.30000/-

First year cost of production per kg Rs.13250/3000 = Re.4.4/kg
Second year cost of production onward per kg Rs.3600/3000 = Re.1.2/kg

(Source : Shuyhunle, POU in-charge Kohima district)

From the above case studies it can be seen that the cost of production per kg ranges from Rs.3/kg to Rs.4.4/kg whereas the selling price is Rs.8/ to Rs.10/kg.

5.4 Turmeric

Activities with man days and rate

1. Jungle cutting 23 man days @ Rs.60/ manday = Rs.1380.00
2. Burning and soil preparation 16 mandays @ Rs. 60/ manday = Rs.960.00
3. Ploughing of field with Ox or Buffalo 3 times each with 16 pair days @ Rs. 70 per pair Rs. 16 X 3 X 70 = Rs.3360.00
4. Purchase of seedling 2000 kgs @ Rs 3 per kg = Rs.6000.00
5. Sowing of seeds/rhizomes 48 mandays @ Rs. 60 / manday = Rs.2880.00
6. Weeding 1 time only 160 man days@ Rs. 60/manday = Rs.9600.00
7. Harvesting and removing of roots 160 mandays @ Rs.60/manday = Rs.9600.00
8. Cost of gunny bags for packing @ Rs.10 per bag for 200 bags = Rs.1600.00

Total = Rs.35380.00

Cost of production of Turmeric per Hectare = Rs.35380.00
(Rupees thirty five thousand three hundred eighty) only

Expected Profit of Raw Turmeric per Hectare :

Expected yield of Turmeric per hectare raw in Kgs = 20,000.00
Sold @ Rs. 3 per kg (raw) = Rs.3 X 20,000 in Rs. = 60,000.00
Profit = Total Sale – Cost of production Rs.(60,000 – 35380) = 24,620.00
(Rupees twenty four thousand six hundred twenty) only

Expected Profit Analysis of Dried Turmeric per Hectare:

Taking 5:1 of Raw Turmeric to 1 kg Dried

Average of finger & mother Rhizome)

Cost of Drying: (Sun drying take 10 days after boiling)
Cost of fire wood of 32 mond @ Rs. 50 per mond = Rs.1600.00
Cost of labors of 24mandays @ Rs. 60 per day = Rs.1440.00
Total cost of drying = Rs.3040.00
(Rupees three thousand fourty) only

The yield @ 20,000 kgs per ha. in raw form will yield 4000 kgs dried form
Prevailing rate is Rs. 17 per kg dried 4000X 17 = Rs.68000.00
Net profit: Selling price – Cost of production+ drying Rs.(68000 – 38420) = Rs. 29580.00
(Rupees Twentynine thousand five hundred eighty) only

Advantage of selling dried turmeric over fresh

Profit from selling dried turmeric	:	Rs.29,580.00
Profit from selling fresh turmeric	:	Rs.24,620.00
Difference	:	Rs. 4960.00

The cost of production of the above four crops viz. ginger, cardamom, passion fruit and turmeric are indicated in Box below

Name of crop	Cost of production per kg	Average selling price/kg
1. Ginger	Re. 1.07	Rs.4.50 to Rs.18/kg
2. Cardamom	Rs. 45.00 (first year)	Rs.70/- to Rs.100/kg
3. Passion fruit	Rs. 3.01 to Rs.4.4/kg	Rs.7.00 to Rs.8.00/kg
4a. Turmeric (Raw)	Rs. 1.94/kg	Rs.3/kg
4b. Turmeric (Dry)	Rs.10.46/kg	Rs.17/kg

Comparing the cost of production and selling price, Ginger cultivation is the most profitable. Promotional works was not required on the part of the project staff to persuade farmers to cultivate ginger as already the farmers knew. The only problem is farmers are often not aware about the market price fluctuation therefore it became the responsibility of the project staff to educate the farmers to fix a reasonable price.

Conclusion and recommendation

Through participatory research methodologies, farmers and POU team gathered information about existing fallow menu crops that farmers are having difficulty in marketing. In assessing the market chain, data on supply, quality, characteristics, market demands, market channels, and economic valuation at different points, transport required and inputs were gathered.

The farmers of Nagaland were in a position to produce crops that have assured market that could fetch remunerative selling price. The constraint they had was that the NEPED project restricted the farmers from taking up crop of their choice because of the mandate of the donors. The mandate being that it should be environment friendly in the sense that the crop should be shade tolerant. However, farmers were more concern about the improvements of their livelihoods and therefore, in addition to the mandated crops they also cultivated crops that are not necessarily shade-tolerant. In several villages, chilli that had high market demand was cultivated. It was seen that in most villages, part of the support provided by the project was used in procuring livestock mostly piglets and chickens as backyard piggery and poultry to earn income so that they are able to repay the loans after they sold them.

A value chain analysis was done to help identify points in the market chain where interventions can support enhanced returns to Naga farmers. This included identification of potential value-addition activities which will enhance the storage and transport capacity of crop products, thereby increasing market value.

Studies were made on the Organic certifying agencies to understand the possibility of certifying the jhum product. So far the indications are negative because the burning and shifting, which is the most important component of shifting cultivation, does not fit into the criteria for organic certification. The products from jhum are virtually chemical free because no fertiliser is used, if there had been chemical utilisation it was only common salt application for weed control. In view of this virtue of being chemical free, necessary steps are being taken up for recognition under Participatory Guaranteed System (PGS). Also, some of the farmers who were supported by NEPED project had applied for Organic certification and there is strong indication that they would be receiving it, soon.

Study on how the farmers' were marketing the menu crops enlightened the project team members to strategise the onward marketing processes. Having come to understand that the quantity of ginger production is high and that farmers would not be able to market the product in their normal market channel, the project made an in-depth search for market linkages and brought trader from Delhi to purchase farmers' product of Nagaland. While this arrangement had partially fulfilled the immediate need of farmers by assisting the farmers in providing

transport subsidy, the sustainable linkage could not be established because of the high cost of transportation. Furthermore, the trader was from Delhi, who had no stake in the product of farmer of Nagaland, although awareness of market forces coming into play on the farmers' product was created. One major lesson learnt in that venture was that local traders were needed to assist farmers for establishment of sustainable market linkage. Realising this, the Government took initiative and entrusted the APMC Kohima district to take on the task and that also was a flop as was indicated in the preceding section of this Chapter.

In the marketing of passion fruit, when the quantity produced was low and farmers were able to sell them in local market at good price, there was no problem. When many farmers started to produce passion fruit with the expectation of receiving good price, a glut was created in the local market and there was surplus production. Surplus product or not, farmers expected good price from passion fruit. Without intervention, the surplus product was to be wasted in-situ. The project did two things to mitigate this problem. The first was to do an assessment of the cost of production so that producers are made to be aware of their expenditures incurred in the production. The second task was conducting a study tour of producers to the Factory sites where these producers were able to discuss with the Factory management on the cost of production of a finished product. In this way the farmers and the factory managers were able to come to understand each other that in order to come with a Win/Win situation they had to agree on a price.

While this arrangement had been considered a success, it was only temporary. The farmers had one or two outlets and there are risks involved should these factories breakdown and are not in a position to consume the produce.

Large cardamom is an exotic crop and cultivated exclusively for outside market. The main problem of cultivating and marketing is the drying process. Most cultivators smoke dry their cardamom capsules that fetched below the prime price but farmers had no alternative. Having understood this problem, the NEPED project had made attempts in introducing Improved Bhatti developed by the Spice Board of India and Up-draft Gasifier developed by Tata Energy Research Institute (TERI). It was observed that they were not compatible with the need of the farmers. The devices were needed to be installed in a permanent location, whereas farmers cultivate cardamom in several sites where they needed to transport the capsule from as far as 5km away from this installed driers. There was also the problem of transporting firewood to the site. In smoke drying process used by the farmers, the drying floors were constructed in the plantation site and firewood was collected in the wood nearby the plantation sites. Thus the farmers prefer to smoke dry their product despite the lower price.
Addressing this problem, a few farmers of Sakraba village in the district of Phek designed a contraption that suited the local condition which was easy to install and user friendly. They decided to call it '*Sawo*'. The cardamom capsules dried in this contraption were found to be superior to the ones that were smoke dried and fetched a better price. This contraption being tried out in other villages as well and response are awaited.

IV. INVENTORY OF TREE POLES PLANTED DURING NEPED PHASE-I AND VOLUMETRIC ASSESSMENT OF TREES REGENERATING DURING FALLOW PERIOD OF JHUM

Background

NEPED I had addressed issues of meeting the increasing demands for timber which were leading to forest degradation while simultaneously addressing problems of erosion, the project supported the plantation of tree crops in the jhum system. This concept attributes its success in part as it built on the traditional mixed cropping system of jhum; the activities simply focused on adding one more "tree crop". In the project period (1995 to 2000), an estimated 7820270 trees were planted in 857 villages. Some of these plantations were too densely planted requiring thinning, while in others farmers were to subject the planted area to shifting cultivation and this necessitated to undertake study on the market of poles. However, the Ministry of Environment and Forests (MoEF), Government of India officials and the Special Investigation Team (SIT) made a discriminatory restrictions on transportation of logs and baly posts raised from private and community holdings to other parts of the country from all NE States except Bairabi station for Mizoram, through a directive from the Chief Commercial Manager (RATES) Maligaon, Rly HQs vide letter No 10.C/30/G/1/P.X. dt 01/01/2001. This resulted in a stand still in the movement of poles and timbers from Nagaland to outside the State, as such undertaking the study of market chain analysis for poles appeared to be a futile effort. It was observed that as expected, in many villages farmers started to either clear fell the trees planted during the project period or thinned the plantation and sold them as poles or firewood.

Assessment of surviving trees planted during NEPED-I was done by the POU team under random sampling. It was observed that in many villages where the villagers had planted local species had slashed them and subjected them to jhum. They also informed that the firewood harvest was much more than what they use to get under conventional jhum system, that is without planting trees.

Table: Summary Of Trees Planted In Nagaland By NEPED Project From 1995 To 1998

SERIAL OF ABUNDANCE	*NAME OF SPECIES*	*NUMBERS PLANTED*	*ESTIMATED SURVIVAL%*	*COMPUTED NUMBER OF TREES PRESENTLY SURVIVING*
1	GMELINA ARBOREA	2600950	60	1560570
2	ALNUS NEPALENSIS	962100	60	577260
3	TECTONIA GRANDIS	726880	70	508820
4	CHUKRASSIA TABULARIS	667080	60	400250
5	MELIA COMPOSITA	575390	50	287700
6	TERMINALIA MYRIOCARPA	375190	70	262630
7	CEDRELLA SERATA	288610	50	144300
8	SPONDIAS AXILLARIS	251750	50	125870
9	AQUILLARIA AGALLOCHA	207650	20	41530
10	DUABANGA GRANDIFLORA	123450	50	61730
	56 others and unidentified local species	1041220	40	613146
	TOTAL	7820270		4583800

Note:

- Random sampling at Test Plot sites had shown that most of the surviving trees had attained a Diameter at breast height (dbh) ranging between 19.3cm to 25.2cm with a height of about 12 to 15 m.
- In some villages the Test Plots sites had been subjected to jhum and replanted with trees. Most of these cases happened at those sites where local trees were planted or natural regenerations were encouraged
- Farmers have started to re-convert Test Plots to jhum even in those areas where Gmelina arborea had been planted by harvesting, in some cases for poles and other cases firewood
- The survival rate of Aquillaria agallocha was poor and those that survived are yet to be value added

Considering the fact that all trees planted during NEPED –I are above 50cm girth and all top 10 species are being sold in the market, one can conclude that 45,83,800 standing trees could fetch enormous income to the farmer. According to the independent assessment made by Prof. Kurt Klein , Deptt of Economics, University of Lethpridge, Alberta, Canada and Dr. Merle Faminow, Project Director, NEPED, IDRC, New Delhi the replication is 1:6 during 1998. Thus the estimated standing trees as a direct impact of NEPED could be computed as six times 45,83,800 and that is 30,502,800 to be surving

Prevailing Pole market at Kohima

- The above top 10 species are all being sold as poles in Kohima Firewood retail sales Depot as follows

Locality	Girth (cm)	Length (ft)	Rate
Kezieke	Below 30	12 to 14	30
	30 to 40	"	40
	40 to 50	12 to 15	50
	Above 50	14 to 18	70
Midland	Below 30	12 to 14	30
	30 to 40	14 to 16	40
	40 to 50	"	50
	Above 50	12 to 15	70
Chandmari	30 to 40	12 to 15	40
	40 to 50	14 to 16	50
	Above 50	15 to 18	60

De-barked poles of 45 to 50 cm girth cost Rs.15/running feet (Data source: Vilatuo & KKath Feb 2007)

1. Sustaining Trees during the Fallow Period through Management of Natural Regeneration in Jhum Fields of Nagaland

1.1 Background

Fallow period is an intrinsic part of shifting cultivation. For an outsider, even to a trained agronomist, fallow land is seen as abandoned. A fallow field is anything but abandoned. In contrast to the alluvial soils in the plains, the soils in Nagaland are relatively poor upland soils. The farmers therefore, are strongly dependent on the ecological processes involved in the species succession of the fallow vegetation in restoring fertility to the land.

Traditional fallow management varies according to its length. Where the fallow period is longer, farmers do not make extra effort to enhance the rate of restoring soil fertility. But where the fallow period is short, farmers consciously influence the patterns of species succession in the fallow vegetation. In the second year of cropping, farmers plant or sow pioneer trees like *Alnus nepalensis*, *Macaranga denticulata*, *Albizzia* spp. and other local species that they consider to be soil-improving. Other farmers who prefer firewood species would plant *Quercus* spp.

In the daily village life in Nagaland, where there are no alternative sources of energy, fuel wood ranks only next to rice in importance for a family's existence. Firewood is not only used in cooking but also for heating homes and a host of other utilities. Therefore, to promote natural regeneration of tree species during the fallow period is one of the most important management strategies in the course of cropping period

An annual average fuel wood requirement in the village is about one '*Thak*' (Stack) per person. One '*Thak*' measures roughly 3x3x6 feet, which works out to be 1.5m³ stacked volumes that in turn are about one cubic meter solid volume. In Myanmar the consumption is also 1m³ (Htun Tin, 1996) in the plains around Rangoon. Which is again comparable to the annual fuel wood consumption in most parts of the world where wood is the main source of energy.

The Naga farmers generally avoid taking out fuel wood from the jhum field during the fallow period because they are well aware that this would prevent restoration of fertility and reduce the production of ashes (nutrients) added to the soil when burning the jhum fields. On the other hand, they are compelled to use part of the thicker woody material when slashing the field for fuel wood. There is also a scientific basis in ~~on~~ the practice of the farmers in splitting the thicker wood and not taking out the thinner branches, which have high content of bark and nutrient. So, by this practice, the export of nutrients from a jhum field is minimal.

While the importance of natural regeneration of tree species during the fallow period was understood, no studies had been done to enumerate them. Therefore, an inventory of natural regeneration of trees in the jhum fallow for fuel wood recovery and management practices was carried out in the 21 villages across the state. The study was sponsored by International Development Research Centre (IDRC).

The main objectives of the study were to;

- identify tree species that have potentials for adding values to the fallow period in terms of cash generation and restoring soil fertility,

- quantify the fuel wood recovery from the jhum field when it would be felled during the first year of cropping period, and

1. explore appropriate ways to increase the number of tree population so as to increase the income during the next jhum cycle
2. understand traditional ecological knowledge (TEK) of the farmers from one community and transfer the 'better' system to other community

1.2 Study Area

The study was carried out in 21 villages in 10 districts of Nagaland covering different type jhum cultivation practised by the farmers. In general, farmer cultivates a plot of land for a consecutive two years and left it to fallow for six to 8 years. However, in some villages such as Tuophema, depending on the type of soil, the farmer cultivate a jhum plot consecutively for four years, whereas in other villages like Ketsapo and Phuktong, the farmers cultivate for one year only and left it to fallow in the second year. The management to induce natural regeneration also differ from community to community. The farmers of Mon are expert at preserving naturally regenerating saplings in their jhum fields, while the farmers of Phek district do dibbling of Oak seeds during the first year of cultivation and preserve them in the second year and left to fallow in the third year. While in other cases hardly any conscious intervention is given to induce regeneration of trees is done. Considering these different system of tree management during the cropping period, villages for the study were selected.

There are 17 major tribes in Nagaland each with distinct features of agricultural system. The people of the Angami and Chakhesang tribe cultivate both permanent terraced rice cultivation (TRC) and jhum. The unit area of cultivated per head of jhum in these two tribes is less than those of its counterpart in other northern districts because, rice, the major concern for the family is produced from TRC. The farmers of northern districts, who are totally dependent on the product of jhum naturally, have more cultivated area per head because they had to produce rice from jhum fields. It was observed that cultivated area per head influences the species diversity of regeneration. This is because mother tree of the remnant forest is too far away to regenerate in the jhum field in those cases where cultivated area per head is high, whereas in cases where cultivated area per head is low, there remnant forest species still available to spread in the jhum.

Extending jhum cultivation into primary forest cannot be ruled out as result of bringing more area under permanent cultivation, enlargement of village area, growing cash crops, planting commercial trees and other land and rural base activities that are more or less sedentary in nature. These cash income generating activities are more dominant on the gentler slopes near village sites, such that shifting cultivation activities are pushed to steeper slopes.

Furthermore, when all possibilities are exhausted, migration to the foothills and plains had been observed. Though the magnitude of such migration had not been quantified, it can be considered as significant. Most of those who have settled in the foothills have given up shifting cultivation in favour of permanent cultivation. As a result of this migration the landscape changes had taken place in the district of Zunheboto where jhum areas are getting reconverted to secondary forest and plant succession is ascending towards climax forest.

In general practice, most of the reserved village forests belong to the community and therefore, extending cultivation area into primary forest requires the village council resolution to that effect. Unlike a couple of decades ago, in recent years the village councils have put more stringent measures against it.

The net result is that a considerable consistency is maintained in the total actual area under jhum ranging between 900,000 to 1,000,000 ha.

1.3 Methodology for inventory of tree species regeneration

Field procedure on Minimum Representative Area was followed.

In this procedure, a stand analysis comprises of all strata from seedlings to pole sized trees to forest giants, all of which require a plot size of their own. The following steps were followed to assess the natural regeneration of tree species during the fallow period of shifting cultivation.

1. Systematic selection method was employed in the data collection. Sampling lines are placed at regular distance along a baseline. Sketch of a sample plot is given below

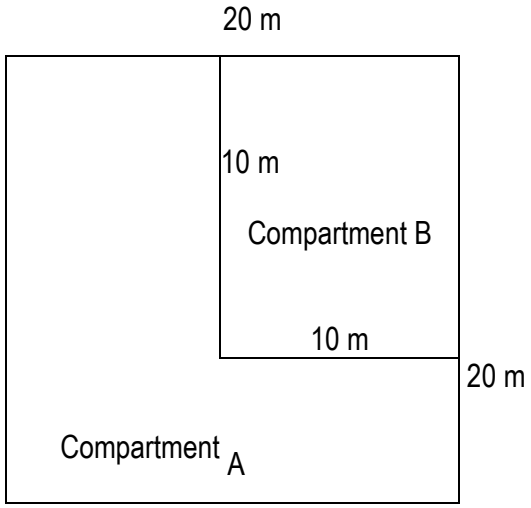


Figure : Schematic design of a 20 x 20 m sample plot

a) Compartment A: 20 x 20 m for all trees of 10 cm dbh and above. 25 such plots were established covering 1 ha.

b) Compartment B: One subplot of 10 x 10 m was carved out from within the compartment A to assess saplings and poles of ≥1.3 m high to less than 10 cm dbh.

2. Distance (D) between one Compartment A to the next Compartment A was determined by:

$D = \sqrt{(c*N*10000/n)}$, where:
D = the distance from one sample plot to the next
N = the total population who are going to cultivate that location
n = the sample size; 25 in this survey
c = approximate per caput area cultivated; 0.22 ha

3. The pole stand parameters in 25 sample plots measuring 400m^2 each were assessed at regular distance (D) making the total area to 10000m^2 or 1 hectare.

Result and Discussions

In the 21 sites studied eight villages had jhum cycle less than 10 years. According to the opinions of several scientists the threshold level is two years cropping and eight years fallow making 10-years jhum cycle to sustain the jhum system. Should this thumb rule hold true for farmers of Nagaland, these villages that have less than 10 years require special attention for intervention. In 10 villages, the jhum cycle is 10 years and in two villages 12 years jhum cycle. In these villages the jhum system is still sustainable. Out of the 21 sites only one had a jhum cycle of 25 years, this village is an aberration from the normal jhum system because the farmers cultivation for four consecutive years and left it fallow for 21 years.

Table 1:Summary of main stand parameters of common woody species (**≥ 5 cm dbh) in a jhum plot** in 21 villages							
Sl. No	Village	District	Number of trees/ ha	Number of species	Volume (m^3/ha)	Basal area (m^2/ha)	Jhum Cycle in no. of yrs
1	Chessore	Kiphire	730	36	89.10	9.40	10
2	Khuthur	Kiphire	788	20	57.31	7.71	6
3	Kezo basa	Kohima	779	79	555.97	15.71	10
4	Sendeynu	Kohima	903	70	472.75	14.41	10
5	Meriema	Kohima	596	46	184.65	14.21	10
6	Phuktong	Mon	2210	97	587.60	39.24	10
7	Kupza	Mokokchung	586	51	37.23	4.74	12
8	Songlhuh	Peren	566	53	221.14	23.27	8
9	Tuophema	Kohima	407	28	50.71	5.41	25
10	Thetsumi	Phek	620	68	184.65	16.20	10
11	Kutsapo	Phek	2794	115	221.14	23.27	10
12	Khomi	Phek	652	28	104.82	9.33	10
13	Chandalashung	wokha	1853	82	391.96	42.42	10
14	Okheyan	wokha	1334	59	527.45	41.29	10
15	Okotso	Wokha	911	75	79.86	13.37	5
16	Khukiye	Zunheboto	632	43	65.68	7.24	12
17	Lukikhe	Zunheboto	552	40	31.97	3.96	7
18	Sungratsu	Mokokchung	420	39	38.02	5.34	9
19	Mohung	Mon	497	21	39.42	9.43	7
20	Koio	Wokha	192	21	8.67	2.18	6
21	Mishilimi	Zunheboto	289	17	5.73	2.05	7
		Average	872.00	52.00	188.37	14.77	

A long jhum cycle of 25 years as in the case of Tuophema has only 407 standing trees because the cropping period is fours and thus very little natural regeneration had taken place during the cropping period. Whereas, short jhum cycle of six years as in the case Khuthur had 788 standing trees because the farmer left it to fallow after the first year of cultivation. In villages where the farmers had followed normal two year cropping and six to eight years fallow, the stand parameter followed a normal trend.

The number of species regenerating after the field is left to fallow ranges from as low as 17 to as high as 115. Out of the 21 sites 11 had number of species less than 50. The villages with short jhum cycle of 6 to 7 years have the least number of species. In sites with high stand volume of 184.65m^3/ha had less number of species. This was because the old stand had suppressed the regeneration of new sprouts. The highest species diversity was recorded in Ketsapo village jhum site having 115 species. The high diversity is attributed to the fact that the cropping period is only one year and at the upper catchment's area there exists an excellent primary forest from where seed propagation was taking place through gravity and by other means of dispersal. These farmers also made an effort to preserve and nurture coppices sprouting from old stumps.

The stand volume m^3/ha ranged from 5.73 to 587.60m^3/ha with an average of 188.37m^3/ha. In villages like Mishilimi and Koio the volume is only 5.73 and 8.67m^3/ha respectively because the farmers had been cultivating the site consistently at regular intervals for a long time. In cases like Phuktong where the number of tree per hectare was 2210 had a stand volume of 587.60

m³/ha because farmers cultivate the site only for one year so that regeneration of trees was prolific. The farmers of this village are adept at preserving the poles during the cultivation. Whereas, in Kezo Basa the number of trees was 779 but the stand volume was 587.60 m³/ha. in this site several large trees were lobed and preserved that had increased the average basal area resulting in the high stand volume.

When cropping period is only one year the species diversity and number of trees per hectare was high on the other hand when the cropping period is more the diversity and number proportionately was reduced. In normal cropping period of two years the diversity and number increase proportionately with the length of fallow period

Thetsumi villagers generated Rs.2.00 lakhs sale proceed from firewood

Thetsumi village of Phek district subjected a jhum location that was planted with trees under NEPED programme in 1997. A study was done to estimate the standing growing stock of trees in this site using minimum representative sampling methodology. The result is as follows:

Average number of trees per hectare : **627**
Average basal area per hectare : **14.45 (m²/ha)**
Average volume **: 190.68 (m³/ha)**

During 2007, this site was subjected to jhum. The trees felled were;

- use in soil conservation measure by laying them along the slope
- retained in situ the support of creeping crops such as French beans
- harvested for firewood where part of it were consumed in households and the rest was sold

The village had sold out about 600m³ to a nearby Pfutsero Administrative headquarter. The village authority estimated that an amount of not less than Rs.2.00 lakh was brought to the village from sale proceed of firewood alone. They also estimated that about 2000 to 2500 trees were harvested for this purpose.

The good thing about this is that an estimated 70,000 number of mostly firewood trees were planted during the year 2007.

The sites where farmers had intervened to induce regeneration all stand parameters were high. This can be seen in the case of Phuktong where the farmers had preserved poles from the previous jhum cycle, had only one year cultivation and consciously preserved and managed sprouting tree seedlings during the cropping period. The result was that 2210 standing tree poles with 587.60 m³/ha

Conclusion

From the study the following conclusions were drawn:

1. The study showed that the main stand parameters of common woody species: Basal area (m²/ha), Volume (m³/ha), number of trees/ ha and number of species/ha are influenced by a number of factors such as, among others: Length of cropping period and fallow period, the intervention made by the farmer to induce regeneration, the number of trees preserved from previous jhum cycle, distance from the standing 'Mother trees' and site conditions.
2. Farmers were well versed about the trees that were sprouting and standing in their field and are either preserving or slashing them according to its usefulness. They are also aware of its biological characteristic as to whether the tree would coppice or die out on cutting.
3. In the standardised tree plantation techniques saplings are raised in nursery, packed in ploythene bags under regular watering and finally transported to the planting site. This standard had its difficulties even if the saplings were given free of cost to the farmers. Transporting the bagged saplings from the road to the plantation site which often are more than 5km is not practical for farmers. Often the species was not suitable to the

site conditions.

4. From this study, it was clear that on an average of 52 species naturally regenerating from the jhum fields, farmers are able to selectively nurture the species of their choice and preserve them. In this way survival is assured because the site conditions are suitable to the species
5. It was found to be better to follow farmer led afforestation technique rather than the standardised technique.
6. As can be seen from the Table above the average number of tree per hectare was 870. Discussion with villagers revealed that an adequate number of trees per hectare were about 1500. This fact led the NEPED – III to strategise afforestation programme to increase the number of trees per hectare by encouraging natural regeneration, direct sowing of tree seeds and or preserving tree saplings that are sprouting in the jhum fields.
7. Experiences from the NEPED – I tree plantation that planting timber species that have long gestation period was not practical for farmers who are pressed for land for cultivation and also needing to generate income for the household. Instead, it was more economically viable to select preferred firewood species and plant them because there is high demand for firewood in market.

PLANTING OAK SEEDS IN JHUM

Oak species are among the most preferred firewood. NEPED project encourages its farming families to plant Oak seeds along with jhum crops instead of timber species because of its short gestation period of 8 to 10 years. This is a convenient species for plantation because the seed size is large enough to easily handle and dibble along with crops.

Seed collections are done in October and November when seed fall is taking place. The collected seeds are packed in empty cement bags and stored in shade. By the end of February or early March, the seeds start to germinate in the bags where the plumule would emerge, as farmer described it, 'like the fang of a dog'. The ungerminated seeds are then soaked in water in a bucket. The viable seeds would sink to the bottom of the bucket which would germinate in about two days. The unviable ones would remain floating on the surface that are scooped out and discarded. This seed germination time coincides with sowing time of jhum crops. Therefore, no extra labour input is required for sowing of tree seeds, in this case. The farmers claim that the survival percentage is than 50%. For planting in fallow land, the seeds are dibbled in the month of January or early February and that would start germinating in the month of March. However, this method of planting in jhum fallows require more manpower for weeding, whereas seeds that are sown with crops require no extra labour inputs for weeding because the farmers are doing the weeding for the crop, the tree seedlings also gets maintained by default.

2. Assessment of firewood consumption

Assessment of firewood used by a family and an individual were done in 47 different villages covering all the districts of Nagaland.

Firewood assessment is made as per the local method of calculation, which is called *THAK*. A *Thak* measurement may be 3X 3X3ft, 3X3X6ft, 3X3X9ft, 3X4X6ft, 3X5X5ft, 3X5X6ft, 3X6X6ft according to village and district. These parameters are taken into consideration while measuring from each individuals and families. They were converted to 'metres' for analysis.

Table: Average firewood per year by 659 families

Sl. No.	Name of District	Total no. of individual	Total no. of family	Total firewood used per year (m^3)	Average firewood used per head (m^3)	Average firewood used per family (m^3)
1	Zunheboto	1134	140	552.14	4.16	29.88
2	Longleng	284	40	617.66	4.44	30.88
3	Mokokchung	731	118	420.39	4.56	24.59
4	Kohima	244	94	420.36	5.00	25.19
5	Phek	316	69	173.16	1.72	10.71
6	Wokha	449	88	314.54	4.36	21.72
7	Peren	721	110	226.84	1.95	12.21
		3879	659	389.30	3.74	22.17

Discussion

From the above, the average firewood utilisation per person works out to 3.74m^3 cu.m. from amongst the villages that we studied. Tuensang recorded the higest, because they burn the fuelwood in maximum almost throughout the day. There are also families burning firewood throughout the day, but it is not as much as as in the case of Tuensang district.

The Table showed that 659 families had consummed an average of 22.17 m^3 of firewood annually. This may not represent the average utilisation of Nagaland but it certainly represents the average utilisation in villages of Nagaland.

In Table… it was seen that the average wood slashed for jhum cultivation was 188.37 m^3/ha. Therefore, with the exception of two villages: Mishilimi and Koio villages, one can assume that the farmers were able to collect sufficient quantity of firewood both for household consumption and for sale when demand is there.

3. Cost Estimation of Timber Operation and Profit Margin

3.1 Background of study site

Timber operation was going in a primary forest that belongs to Pholami village 115 km east of Kohima. The logging site is located at about 3km above Pfutsero – Phek NEC road in the district of Phek. The village council had sold out the identified trees to individuals who are also Pholami citizen.

The present study was undertaken to understand the cost of operation from felling of trees to sale at Kohima. In most cases of logging, labourers are normally Nepalis, as such it also an objective of this study to find out as to how much of the cash generated from a timber operation is ploughed back to the village.

3.2 Methodology

The researchers developed a rapport with the village council and the timber operators who were operating in the forest where they had purchased from the village council. In this particular patch, more than five timber operators were extracting. The researchers were able to obtain the permission of the village council as well as the operators to camp in the site to observe the process of extraction from felling of trees to transporting from the logging site to the road side by head-load and then transporting to Kohima by Truck.

Table 1: Cost of timber operation in a location at Pholami village forest

Sl. No	Item of work	Qnty.	Rate (Rs.)	Amount
1	Cost of round ft^3	750	10	7500.00
2	Cost of tree felling ft^3	42	15	630.00
3	Cost of section	750	4	3000.00
4	Cost of logging	750	6	4500.00
5	Cost of platform construction	1	600	600.00
6	Cost of sawing	500	35	17500.00
7	Cost of siding	500	20	10000.00
			Sub Total	43730.00

Table 2: Transportation cost from Pholami village to Timber Depot, Kohima

Sl. No	Item of work	Qnty.	Rate (Rs.)	Amount
1	Loading charge	1	1000	1000.00
2	Vehicle hiring charge	1	7000	7000.00
3	Gate entry charge	10	560	5600.00
4	Unloading charge	1	600	600.00
5	Food and tea	3	200	600.00
			Sub Total	14800.00

Expenditure Grant total Table 1 + 2 = 58,530/-

Table3: Sale Proceed at Kohima

	Item	Qtty.	Rate	Total	
1	Batan	200 ft^3	140	28,000/-	
2	Ekk	300 ft^3	150	45,000/-	
		Sub total		Rs.73,000/-	

Profit Margin: Rs.(73,000 - 58,530) = Rs.14,470/-

3.3 Result and discussion

The timber operators knew that when a number of trees with 750 ft^3 stand volume are felled roughly only 70% of the volume is recovered for sale and about 250 ft^3 is lost in the operation. It was observed that the felling of trees and construction of sawing platform was done by hired hands from the village and then other process from sectioning to siding at the sawing platform; sawing and transporting them to the road side are all done by Nepalis who were hired for the purpose.

From the Table.1. above the total cost of operation is Rs.58,530.00 out of which the villagers were able to earn only Rs.9100.00 the rest Rs.49430.00 are earned by outsiders. The Nepalis earn Rs.35000.00 and an expenditure amounting to Rs.14430.00 went to other costs such as loading, unloading, wayside expenses on food and snacks, toll taxes and other indirect costs.

Sawing was done manually as such the 30% of timber were abandoned as leftovers. It was observed in many old sawing sites that these leftovers were rotting. While the rotting wood would add humus to the forest and not be completely wasted, some villagers had added value to these pieces of wood and are earning good income. Adding value was done in two ways: dress the wood in – situ into planks and transport them to the roadside and sold as *'Buri* a type of second class plank. The other form of adding value to leftover wood was to transport them to the roadside and transport them to Sawmill that are in cities by Trucks and saw into planks of assorted sizes that are easily sold because their price are half the normal planks. In this way, what would have been wasted in the forest was recovered fetching income for those who could add value to the leftover.

The timber operators are individuals who were considered the wealthy ones. However, when timber operation come into full swing, many of them take loan form private individual at a rate of interest of 60% to 120% per annum. There had been occasions when there is a road blocks largely because of landslides or other calamities that prevented them from supplying them to the market, the timber operator incur huge losses largely because of borrowing cash at exorbitant interest rates.

3.4 Conclusion

Looking at the profit margin and the time spent to operate one Truck load of sawn timber from tree felling to sawn-timber that could be transported to Kohima, if had taken not less than one month. Considering the profit margin of Rs 14,470.00 is not much. The risk involved of incurring a loss is high due to bad of road condition, the unauthorized taxes on the wayside and unforeseen expenses. This fact had been expressed by many operators. When asked why they do it, their reply is that it is the only source of cash income they could generate.
From the study, it could be concluded that the main persons who are profiting most are the retailers at Kohima Timber Depot and the Truck Owners.

V. ADDING VALUES TO THE FARMERS PRODUCTS

Farmers of Nagaland are capable of producing crops that have market demand. However, the main constraint faced by them was transporting them to market especially those that are bulky and are easily perishable. To address this was to add value in the village. Value addition includes imparting training on post harvest technique, providing information and supporting them in acquiring appropriate technology for value addition to the product.

Identifying the value addition need of the farmers was the most important work that the team members worked on. It was observed that in many cases, although the value addition technologies were beyond the means of the farmers and the project resources as well, there were some activities that farmers could do at home and increase the value of their produce. In other cases exposing them to the factories and buyers who inform the farmers the quality of the product from them and price the farmers could expect, did add value to the product. Some of the works done are highlighted.

1. Passion Fruit

Quality control is a major challenge for the farmers, as it is not easy to maintain the fresh and attractive colour of the fruit for long. For local consumption farmers were familiar with the quality that the consumers wanted. But when it comes producing for processing in the factory, they tend to be careless about the quality and pack their product in jute bags in large quantity which results in damage during the collection and transportation process and as result the factory owners reject the damaged fruit resulting in losses for the farmers. When farmers harvest the fruits long before transportation it results in over-ripening and damage on arrival, and are rejected by the buyers; whereas those that are harvested on time arrives fresh and in good condition. Those that are packed in cement bags are in better condition, in other words, packaging in smaller quantities reduces damage to the fruits. This experience from Wokha was shared with farmers of other districts that added value to the product indirectly in terms of reduction in the quantity that was rejected by the factory owners.

The NEPED project also, as a trial provided small unit of juicer to the a few villages for trials, but factory owners were not in a position to purchase this semi processed product for the simple reason that they were unproven and not certain as to whether the specifications required by the consumers were adhered to. Because of this the small scale unit being operated by the villagers is yet to take off in the scale envisaged.

2. Cardamom

Only dried cardamom capsules can be sold to outside traders. The process of drying cardamom capsules is a challenging task. The drying process takes a long time and huge quantity of firewood is consumed. Improper drying i.e.; being exposed to direct smoke, reduces the quality of the capsules, thereby, the market value decreases.

2.1 Improving the methods of drying cardamom

NEPED introduced two new improved drying technologies- the Up-draught gasifier system developed by Tata Energy Research Institute (TERI), and the Improved Bhatti Systems developed by the Spices Board of India. These improved curing systems dry the cardamoms through indirect heating at about 45 -50 degree centigrade to give better quality and appearance. Among these two systems, TERI's up-draught gasifier produces more intense heat, therefore, care should be taken to frequently turn the capsules while drying, or else, it will result in the scorching of the capsules.

2.2 Impact on Government

The findings had impacted the government of Nagaland. NEPED assisted the government to procure both these drying technologies for distribution to farmers so that quality of cardamom is maintained. Some project villages like Sapotimi in Zunheboto district and Sakraba in Phek district have developed their own drying units, and have reported excellent results. NEPED encourages such local innovations as these are more farmer-friendly and the farmers are more comfortable with less complex technologies.

A study was undertaken to compare these two technologies in terms of drying quality, drying capacity and operational cost. The table below shows the findings of this study;

Table: Comparison of curing capacities of the two technologies

	UP-DRAUGHT GASIFIER SYSTEM	IMPROVED BHATTI SYSTEM
Drying Capacity	400Kg per batch	200Kg per batch
Drying Time	6 hours per batch	16 hours per batch
Fuel wood per batch	Hard wood- 70 Kg Soft wood- 100 Kg	Approx. 6 Kg
Cost of Fabrication	Rs. 15,500/-	Rs. 15,500/-
Cost of Installation	Rs. 5000/-	Rs. 5000/-
Availability of Material	Some components are not available locally	Materials locally available
Labour Requirement	Constant supervision	Less supervion required
Quality of Cardamom	Good	Good

2.3 Farmers' View

Farmers say that well dried capsules produce a brittle sound, when a few of them are shaken in cupped hands. Also when fully dried, the small tail at the apex of the capsule starts falling off. At this stage optimum quality is obtained. The price for cardamom is volatile as it is governed by the price at the national level. The agents who come to the village for purchase refuses to buy the consignments when price at the national level plummets.

A NEPED project survey team visited the Spices Board Office and met Shri Nallakanau, Deputy Director and his colleagues. After a thorough deliberation, he insisted on seeing the cardamom sample to extend help in finding market. He suggested that the moisture content in the dried capsule should not be more than 13% and should give a brittle sound on shaking in order to fetch a better market. He further said that farmers' training on drying cardamom capsule is to be conducted by the Spices Board, for which information had been sent to the Directorate of Horticulture.

2.4 Lessons learned on harvesting and curing processes in-situ:

The project members conducted a transect walk with farmers to the demo plots and discussed various techniques of harvesting cardamom. In the interactive process several methods of harvesting and harvesting tools were discussed. Much of the discussions took place among the farmers themselves. Some of the results of the discussions were as follows:

- The optimum time of harvest is indicated by the maturing process of the capsules, which starts from the base of the head and so when the top capsule dries up, it is time to harvest.

- The recommended technique for harvesting is to cut the fruit bearing stem at one and a half feet above the ground ten days before the harvest. This would ensure the metabolism process of the plant to provide food to the capsule. Doing this, the fruit quality improves. The wet dry weight ratio is also reduced as a result the recovery rate is better and time of drying is shortened because moisture content is decreased. One of the farmers from Mohung village had tried this process and endorsed this fact and shared with his fellow farmers.
- Farmers of Ngangching and Mohung compared their cardamom harvesting tools. It was our opinion that the harvest knife of the Mohung farmers was handier as it results in less damage to the growing stump because the cutting edge is smaller than the ones being used by the Ngangching farmers.
- It is important that the harvested capsules are washed immediately. This is because the fruit bearing is at the base of the clump, which is in contact with the soil and therefore, becomes susceptible to attack of micro-organisms, resulting in the early blackening of the capsule. The washing of the capsules prevents this process and thus retains the brownish colour.
- The farmers' perceived threat on cardamom plantation is that if vast tracts of land are put under cardamom plantation, there will be no more land available for poor farmers to jhum.
- The value addition techniques adopted by the villagers for drying cardamom involves drying over fire, sun drying by spreading the capsules over CGI sheets. Intense heat applied on the capsules makes them crack.

2.5 Recommendations

- Since small quantities do not attract market, entrepreneurship needs to be encouraged so that a collection point is established where farmers with small quantities collect their produce and send out huge quantities to the market.
- Improving the communication systems will also go a long way in aiding the farmers in obtaining latest information on market opportunities and prevailing global price.
- Construction of good field huts will enable farmers to spend more working hours in their fields.
- Providing water reservoirs would also be an added bonus, as during dry spells crops can be watered from such reservoirs.
- Bee rearing in the field can also be encouraged to help cross-pollination of the crop.
- Some of the improvement measures that can be adopted in order to generate better income would be to encourage and create awareness amongst the farmers to grow more in order to capture good market and generate more income.
- Initial assistance in making transport available would pave the way for a sustainable linkage with the traders in Guwhati. This is so as some farmers have contacted markets in Guwahati, and have been assured good price; however, transportation of the produce to Guwahati is a big hurdle for the simple villagers.
- Government should come in by way of support price to farmers as the threat confronting the villagers is the frequent fluctuations in price, and incidence of pest and disease attack on cardamom plantations.
- Sun drying produces the best quality; however, it takes more time and sunshine is not always constant. Training on drying technique needs to be imparted to the villagers so that quality is maintained and farmers get the best price for their produce.

3. Turmeric

After harvesting the turmeric, the process of removing the root from the rhizome is a difficult and tedious process. Washing the rhizome and boiling before drying is also a tedious and slow process. Sun drying of the boiled turmeric takes a long time. During night time, dew drops add moisture to the already drying turmeric. Up-draught gasifier which was installed by NEPED dries the turmeric very fast, however, firewood consumption it very expensive.

Recommendations

- The technology on value addition required by the farmers urgently is in large capacity boilers and machines for shelling the hard skin of dried turmeric, crushing and powdering.
- Government should assist farmers in providing modern machinery like tractors and power tillers, as farmers invest a lot of time and energy for field and soil preparation, usually the big chunks of soil excavated during the last harvest becomes very hard to break while preparing the field for the next planting season.

4. Exposure of farmers to market and processing units

It was the aim of the project that the farmers see for themselves the existing market potentials, pricing of the product and also explore the terms for establishing market linkages for their product. Towards this end NEPED conducted a study tour for farmers to different Industries.

Eight (8) APMC members from Kohima, Phek and Wokha were taken to Punnanamei and Tadubi in Manipur during September 2004 to explore market outlet for passion fruits and oranges as market has become a pressing need. For instance, the APMC of Wokha had an estimated 200 MT of passion fruits production in the current year. Out of which almost 30% is either marketed locally or spoiled due to non-availability of proper market channel as reported. Likewise, other districts are also expecting good harvest of passion fruit. As experienced previously, the FTC at Longnak and NIP at Dimapur in Nagaland had limited demand to absorb the whole productions of passion fruit from farmers due to fund constraint. As a result, the nearest factory viz. Exotic Juices Limited, based at Punnanamei, Manipur, managed by the 'Good Samaritan Social Services Association' is seen as the answer to the problem as they are in search for raw materials to feed the factory.

After a brief deliberation with the Managing Director (Dikho), the APMCs of 3 districts were informed to send 2 members each to NEPED to:

- Facilitate meeting between the buyers and the APMCs, the apex body for marketing at the district level
- To sign MOU,
- Fix collecting points and rates of raw materials,
- Strengthen the tie between producers and consumers and
- Production survey in NEPED villages

4.1 Some technical information gained on the passion fruit

- Depending on the climatic condition, passion fruit normally has two harvesting season in a year. The first harvest start from May-September and second harvest is from October-December. Whereas orange will be saleable w.e.f. November to January.
- Before planting, pitting should be done with size 1.5 ft cube. The spacing should be 3x1 metre row-to-row and plant-to-plant respectively.
- It is always advisable to add compost in each pit. To do this, 'In-situ compost pit' is recommended which becomes usable within 3-4 months.
- The best time for harvest is when the fruits are ripe and fall by it. These are carefully collected and stored under shade so that the colour is not affected.

- It is recommended that the small farm holders can sustain their livelihood with 1-acre plantation, which can accommodate at least 600 plants. It is so far experienced that a single plant can yield 7-30 Kg up to 4th year after which the production declines.

The factory had been making payment at the rate of Rs 9/- kg on the spot (both cash and cheque) after weighing the raw materials. During the trip, the team members were also shown the various stages for processing and packaging of passion fruits as follows:

- Trough: fruits are first dumped, sorted and washed in running water.
- Passi-press: fruits are pressed and pulped out
- Pre-heater: fruits undergoes for pre-heating
- Centrifuge: the pulps are filtered
- Chiller/heater: pulp is chilled and immediately heated so that the flavour is not lost.
- Sterilization: whatever is produced in this unit are all sterilized
- Concentrate: this is most important part for export business. For example, a bulk of 10 lit of pulp is concentrated to 2.5 litres, which is durable up to 1 year.
- Packaging: pulp is packed in plastic pouch for export.

4.2 Feedbacks from participants

- This trip is an eye-opener and a learning experience to APMC members. They were encouraged that such a big factory is coming up next door to consume the farmer's produce.
- NEPED project is an organization involving grass root people and meeting the ground realities of the farmers. After visiting the factory physically and interacted with its staff, the visiting guides have gained lots of technical knowledge and became more resourceful.
- Sharing various experiences with different districts on APMCs organization is very informative to strengthen the relationship and help each other better.

4.3 Lessons learnt and Recommendations

- Joint seminars/workshops in passion fruit growing areas with resource persons from Agriculture, Horticulture, Land Resources, Industry and Banks should be organized for growers.
- Assessment of cost of production played a very important role to work out for support price and transport subsidy. NEPED therefore, had undertaken a study for reviewing cost of production and cost analysis of crops such as Ginger, Passion Fruits, and Cardamom immediately for reference by other departments to rationalize marketing.
- More trips would be required to tie up market linkages in the future. The value of fruit-products needs to be publicized through media, workshops/ seminars for marketing of finished products. The growers also need to know about the appropriate rates of raw materials and sustainability of the market outlet.
- The marketing units viz. APMC, VMC and Entrepreneurs be strengthened through sharing market information, exposure trips and trainings. The State Level Marketing Board under Agriculture Department is strengthened to take care of quality control, rate fixation, support prices and transport subsidy.
- Identify the feasible units for processing of cash crops thereby encouraging farmers to produce at commercial scale.

- The various activities of farmers and govt. programmes are coordinated so that the projects/units are sustained and make both the producers and consumers benefit in the long run.
- So far two departments viz. Horticulture and Industries are prominently running Fruit Processing Units in a big way in Nagaland. But due to fund constraint, both are functioning at a loss. There is a need to restructure and sensitize the concerned authority to allocate more funds so that all the produces of the farmers is absorbed at reasonable rates.
- Organic food products have high export demand. Hence, it is necessary to train farmers to raise and manage organic crop and reap this advantage.

CHAPTER – II
FULFILLMENT OF OBJECTIVES

I. ACTIVITIES PERFORMED ON RESEARCH OBJECTIVES:

Objective 1: To identify and test sustainable cropping systems and patterns that enables an extension of the cropping phase thereby intensifying the jhum system.		
Activities	Methodologies	
1.1 Analysis of existing practices to extend the copping cycle I in Nagaland and Asia		
1.11 Documentation of practices of local innovative farmers extending cropping phase.	- information collected from POU team members in phase I about innovative farmers - interviews with key women and men farmers about innovations, lessons learned, success stories.	7 cases: Leangkonger; legume Lazami; soil management Sungratsu; sedenterisation Pfutsero; sedenterisation Khonoma; Alder based Konyak Jhum; preserving natural regeneration Sakraba; NRM Strategies
1.12 Review of success stories and results of extending the cropping cycle in jhum systems in other countries in Asia	- literature review, desk top study - analysis of potential applicability in Nagaland	Through web and literature search, the different forms of shifting cultivation practices across the Southeast Asia were referred and tried out at the Demonstration Plot, Meriema. In this demonstration, farmers of the neighbouring villages were employed to try out. The comments received from these hired hands were used as indicators for possibility of upscaling. They commented that a form of Puerto Rican Terrace is practised by farmers by placing pebbles and stones across the slope but it is not possible to construct consciously because they have no time to be doing that. In case of Hedgerow, the space given to 'unproductive plant is not viable'. Other technique such as, A-Frames, Conservation Agriculture, Line Sowing were also tried but not viable for upscaling.
1.2 On-farm testing of possible cropping systems and patterns		
1.21 Close examination and definition of options for experimentation and testing on-farm	- examination of potential cropping patterns e.g. double cropping relay and mixed cropping, cropping rotation in 3rd and 4th year intercropping options	Upscaling of SARS Model in 8 villages of 8 districts. Lessons: Would succeed when: -All villagers are involved because shifting cultivation as a practise is gregarious in nature to: maintain foot path to the field, mitigate pressure of crop losses to wild life especially birds, preparing firebreaks and manage cattle grazing

	- soil erosion techniques - scale up of existing SARS experiments on crop rotation (rice bean, velvet bean, soy bean)	-Cover crop seeds are made available on time and in sufficient quantity (Gender anlysis) -Crops that have demand in the market -In villages where there is acute pressure on land
1.22 Identification of innovative farmers to conduct on-farm trials	- identify "nucleus farmer" who may recommend 3-5 other farmers - criteria for selection farming families includes: innovative, economic security, reliability, interest, accessibility, labour	Processes: -Interaction with village elders -Interview selected farmers -Rapport building -Selection of sites (criteria built)
1.23 Implementation of on-farm trials	- trials with identified farmers on 5 ha demo plot - SARS to scale up to larger number of farmers?	-Trial in 8 villages in 8 districts -
1.3 Assessment and evaluation of potential cropping systems and options		
1.31 Assessment and evaluation of external factors impacting on the applicability of tested cropping systems	- data collection on these aspects from field based interviews with village elders, other village members, POU members' knowledge - data analysis assisted by external resource person - generate report to inform viability of new options	Farmers' comments: -Conceptually good but too much work -Fencing is required from cattle -Additional labour required to maintain footpath to the field -More labour inputs to maintain 3 to 4 jhum plots Based on this report SARS team studied and designed; -Tithonia trials -Broom Hedgerow (Been tried out in Kutsapo in this phase)
1.32 Evaluation and farmer evaluation of experimentation		
1.23 Ongoing dialogue between SARS and POU re: on-farm trials	- structured updates and discussions on on-farm trials	Eg. POU and farmers observed reducing number of natural regeneration of trees due to salt application. SARS tried and brought out recommended doses of salt application, if at all farmers HAD to apply salt

<table>
<tr><td colspan="3">Objective 2:
To develop and extend improved approaches to more productive management of jhum fallows thereby improving incomes and reducing jhuming pressure on remaining natural forests.</td></tr>
<tr><td>Activities</td><td>Methodologies</td><td></td></tr>
<tr><td colspan="2">2.1 Analysis of existing practices in Nagaland and Asia</td><td></td></tr>
<tr><td>2.11 Documentation of fallow management practices of Naga women and men innovators</td><td>- information collected from POU team members in phase I about innovative farmers
- interviews with key women and men farmers about innovations, lessons learned, success stories.</td><td>-Direct observation of crops grown by the villagers
-Discussion with key women and men informants
-Developed criteria of menu crop
-Shade tolerant
-Low volume and high value
-Known to have market demand
-Farmers are familiar with its cultivation
-Planting materials could be obtained without much difficulty</td></tr>
<tr><td>2.12 Identification and lessons learned from best practices of fallow management in Asia
(within Nagaland, NE India, Hindu-Kush-Himalaya region, Asia-Pacific region).</td><td>- literature review, desk top study including a review of papers presented at Improved Fallow Management workshop in Bogor Indonesia, 1998
- exposure visit where applicable
- analysis of potential applicability in Nagaland</td><td>- POU and SARS team provide information on
-market demand, seed sources and varieties
-Cultivation technique
-Farmers and NEPED agreed</td></tr>
</table>

2.2 Consultation with farmers on crops and fallow management		
2.21 Identify key crops which may be integrated in fallow management	- gather information on market viability - establish crop menu according to criteria (altitude, commercial viability, farmer preference, shade-loving) - tentative list includes cardamom, black pepper, ginger, soybean, passion fruit, turmeric	Tentative list: cardamom, black pepper, ginger, soybean, passion fruit, turmeric. Developed by SARS team in the first phase and validated with farmers -Discussed with village elders and selected farmers and location of the plot with following criteria - near road side to showcase - select appropriate crop for the site and also farmers had interest in it - farmers had experiences in the cultivation - both project officials and farmers have some information about its market potential
2.22 Confirm farmers' interest in introducing fallow management practices	- village based meetings	Full disclosure about the activities, it requirements on fulfilling the obligation to the project, the sacrifices that the farmers may have to make and perks that the farmers were to receive in this partnership ventures was done with the farmers.
2.23 Identify farmers' needs for fallow management and preferred crops	- PRA methodologies (matrix scoring, focus group discussions)	The village authority identified the farming families who were innovative, sincere trustworthy and able to communicate with fellow villagers.
2.3 Document best practices for cultivation and management of menu crops, tree species	- literature review of management of identified crops - collection of primary experience in other parts of India on management of crops - collection of siliviculture and tree management practices for tree species planted in first phase.	-50 tree species identified for fallow management during the first phase -inventorised 21 fallow sites and identified (local names) tree species growing with uses -compared standardized afforestation technique with farmer led and found that in large scale plantationin jhum, farmer led technique is far more successful Direct sowing of seeds, seed dispersal, preserving sprouting seedlings etc - Designed thinning procedure in consultation with Departments of Forests and Land Resources Development for the farmers
2.4 On-farm testing of cultivation of crops and other fallow management practices		
2.41 Identification of innovative farmers to conduct experiments	- identify farming families according to criteria	Established in 8 villages is 8 districts -'Menu crops' cultivated underneath growing trees -Served as training ground and farmers' 'day out'
2.42 Conduct on-farm trials	- selection of crops as above	Both on- station and on-farm trials were conducted by SARS team on Tithonia as

	- selection of appropriate varieties for best growing conditions in Nagaland and to meet market demands - support/training to farmers in cultivation/ management of crops and tree species. - measure of yield, soil fertility, problems in production	fallow management of plant in short jhum cycle was carried out. Study was carried out on the cause of high cardamom mortality during the recent years and appropriate remedy measures were recommended.
2.5 Assessment and evaluation of crop cultivation and management		
2.51 Participatory monitoring and evaluation		
2.52 Ongoing dialogue between SARS and POU re: on-farm trials	- structured updates and discussions on on-farm trials	

Objective 3:
To analyze horizontal and vertical market linkges and institutions in order to strengthen farmers' ability to market poles and selected fallow crops

Sub-objectives:
- Develop mechanisms for improving local farmers' access to market channels.
- Build and/or strengthen institutions at local level to facilitate marketing.

Outputs:
- assessment of markets (gaps, weaknesses, strengths, opportunities) re: menu crops, poles

Activities	Methodologies	
3.1 Identification and analysis of existing village level marketing systems and involved institutions in Nagaland	- in-depth study and analysis of existing marketing systems in Nagaland – up to 5 case studies selected from examples of informal markets in villages, village marketing boards, VDB marketing center, government marketing boards - village level analysis will include a participatory SWOT analysis of the strengths, gaps, weaknesses, of existing institutions, village based interviews	Case studies on how villages were marketing 'menu crops' and others in seven villages -SWOT analysis -Whether or not APMC and VMC had assisted farmers and how it could be strengthened

3.2 Market Analysis of "menu crops"		
3.21 Identify fallow management (menu) crops farmers are currently producing and having difficulties in marketing	- PRA methodologies with farmers, key interviews	PRA tools employed and found out what are the crops that had surplus production. Apart from the agroforestry crops, maize was being produced in large quantity that could be value added. Presently farmers are cultivating it mostly for pig feed.
3.22 Assess market channel of menu crops	- gather information on supply, quality, characteristics, market demands, prevailing prices at different points consumer preferences, economic valuation and different points, production to consumption chain/value chain analysis, transport required, inputs, value addition	Assessed transport assistance requirement for Ginger market and provided by the project to the project villages -This gesture attracted the attention of Govt. who also assisted other villages -Market chain analysis for Sarso with an objective of providing value addition was done and found that it was benefiting migrant wage earners
3.23 Estimate potential supply of menu crops	- analysis of yields, farmer interviews	Yield assessment by the POU in the villages made the team realized that transport subsidy was required in marketing -
3.24 Cost/benefit analysis of identified crops	- consultant studies through desk top review, key interviews taking into account quantum of product needed for viable price, cost of inputs, value addition, possible market fluctuations	Cost of production for ginger, passion fruit, turmeric and cardamom. -This activity led to transformation of farmers' perception of pricing their product wherein a Win/Win situation was created in the marketing of especially passion fruit and ginger -promotion of turmeric cultivation was automatic in the neighbouring villages of Bade
3.3 Market Analysis of poles from species planted during NEPED Phase I	- assessment of supply/demand of poles - value chain analysis - investigation of demand to assess market target, consumer purchasing power, desired volume, desired characteristics, opportunities for Naga products to be competitive	-Assessment of surviving trees of NEPED-I was done -21 Case studies on sustaining trees in jhum -Firewood market from trees planted in 1997 -Firewood consumptions per head/family across Nagaland

3.4 Evaluate organizational and institutional needs for efficient marketing of local products	- assess need to create bulk through village clusters	Exercise on crop zoning and formation of village clusters to cultivate one or two identified crop(s) was carried out.
3.5 Development of recommendations for possible market strategies	- analysis of market situation and economic viability of strategies to develop recommendations for potential interventions	<u>Summary of Recommendations</u> - extensive and intensive capacity building on post harvest technology for ginger and passion fruit - identification and/ or contraption of small and village scale value addition appropriate technology - support to local entrepreneurs for venturing into rural marketing - market chain analysis and value addition on uncultivated commercial plants - exploring the potentials of integrating jhum products into Special Economic Zone (SEZ), Nagaland and Participatory Guaranteed System (PGS)

Objective 5: To contribute to the development of a sustainable credit system at the village level which will enable farmers to have access to credit to improve the production of specified crops. Subobjectives: - To develop and test a revolving credit system at the village level. - To work with villages and vDB's to evolve appropriate and effective credit mechanisms at the village level. - To ensure that women access and use 25% of villages credit funds.		
Outputs: - A model for a revolving credit system appropriate for Nagaland that may be adapted at the village level.		
Activities	Methodologies	
5.1 To confirm farmer demand for small scale credit mechanisms at the village level.	- village level meetings	Built criteria for selection of villages and discussed and confirmed with village public on the need for rural micro credit in 105 villages across Nagaland
5.2 Analysis of existing small scale credit mechanisms in Nagaland and Asia		
5.21 To study existing small scale credit	- analysis and lessons learned in up to 3 cases studies may include:	Confirmed in all the identified villages the on-going interest rates

mechanisms in Nagaland	- "Naga Loan" - cooperatives and Self Help Groups	of 'Naga Loan'.
5.22 Review of experiences of small scale credit elsewhere in Asia	- review, analysis of structure , process, successes, challenges, lessons learned of small scale credit schemes such as: Grameen Bank (Bangladesh), Malaysia, SEWA, RGVN (Guwahati) - exposure visits to selected institutions	Literature review on Grameen Bank, Albanian Development Fund, SEWA, RGVN (Guwahati)etc. They provided insights into operation of micro-credit operation
5.4 To support women's access to and use of small scale credit		
5.41 To develop strategies to encourage villages to make land available for women so that they may access credit and retain benefits	- review of SHG and co-ops to draw lessons learned - work with women's society - identify different options for women's collateral - be flexible in identifying other suitable activities for women	Mandatory allocation of not less than 25% of the 'Revolving Fund' to women necessitated the project team members to have close monitoring. Base on observations, flexible collaterals and activities for women were strategised.
5.42 To develop checks that ensure women are accessing and using 25% of village credit funds	- work with village council and women's society to identify potential checks - PM&E	Close monitoring of the village authority to ensure that women's due share become one of the main thrust of the project. In most of the villages where women were made to actively participate in the project, they were allocated 80% of the fund and just 25%
5.5 Continuous participatory evaluation of village level credit systems		

CHAPTER – III
CAPACITY – BUILDING

I. ENHANCING THE CAPACITY OF STAKEHOLDERS ON NATURAL RESOURCE MANAGEMENT

Considerable amount of capacity building activities were taken up in the project villages during the project period. The impact of these capacity building measures has become evident by the ease at which the village functionaries now handle the micro credit mechanism. The confidence developed by jhum farmers to take up cash crop plantation in their jhum fields and timely repayment of loans. Most of all, it has impacted the farming community so much so that, a paradigm shift has been brought about from subsistence agriculture to large scale production.

The project involved meticulous and detail study of each development stages of the project activities. The need for building research and administrative skills of the project staff was felt. Therefore, the project team members were updated through trainings and workshops on various research tools and skills. A curtain raiser towards capacity building of the project members has been a Participatory Rural Appraisal (PRA) training workshop, held with experts from PRAXIS, India, during 18-23 June, 2001. The learning from this training immensely contributed to the smooth sailing of the project. As the project dealt directly with agriculture, the project team members were capacitated on need base, to emulate best practices and new techniques especially in areas like land treatment and soil and water management. The members also made study tours to places where similar project activities were established and practiced. Lack of market linkage and infrastructure has plagued the Naga farmers for long. The project envisaged at redressing the same, consequently the project conducted market surveys for market linkages to provide the right information on value addition and other infrastructures for drying, curing, processing etc, to the farmers.

A major achievement of NEPED project has been the impact on women. Cutting across all traditional customs and beliefs, women-folk were brought to the fore front of development. They have been sensitized and empowered to participate not only in the project activities, but also, to have their say in decision making at the village level. In order to make women's participation in the project measurable, transparent, realistic and sustainable, NEPED had emphasized formation of women into "organized" SHGs and encouraged them to engaged themselves in land-based income generation activities. District and village level workshops were conducted to empower women to actively participate in all spheres of project activities. Women groups were exposed through study tours and field exchange visits. Capacitating and empowering women became so successful, that some village authorities (VC/VDB) began to fear that introducing more women SHGs might tape all external funds meant for the village in general. However, such village authorities were sensitized keeping in mind, the long-term benefit for women beyond NEPED project.

A major thrust of NEPED was to strengthen and reinforce the existing unique village institutional set up to function as Non-Banking Financial Institutions. The village functionaries'- the Village Council (VC) and the Village Development Board (VDB) were made to function as grassroots level credit institutions operating a credit revolving fund mechanism.

They were made to take care of a corpus fund made available for providing micro credit support to the village farmers in the form of loan. They were capacitated to maintain transparency while assessing the credit need of the farmers applying for loan, evaluate the mortgage proposed and finalize the selection of the beneficiaries in the presence of a project member in-charge of the village. They were also made responsible to ensure that the loanees

use the fund for activity for which the loan is given.

1. NEPED PROJECT WORKSHOPS AND CAPACITY BUILDING ACTIVITIES:

Workshops were conducted in all the district headquarters at district and village level through out the project period for proper project implementation. During such workshops, each village functionaries/representatives including women were made to present the state of the performance in their respective villages and were made to share their experience with the project activities and progress on issues like field implementations, the Revolving fund and related activities such as recovery status, recycling of the recovered amount, SHG formation and related activities. In such workshops special emphasis and attention are made on interactions relating to field implementation and account maintenance. Through these workshops the village functionaries gets opportunities to clear their doubts and also get trained on book keeping. The project members through such discussion compile progress reports of each village for documentation.

In these workshops NEPED project members always made it a point to reiterate the need for the project farmers/beneficiaries to accept and develop a sense of ownership over the project. The project members also impresses upon the need for better coordination between village functionaries and the farmers at large. In this kind of workshops views and experiences were shared among the villagers and the village functionaries. Updated records and documents pertaining to beneficiaries/loanees of the respective villages and progress of field activities are also presented during these sessions. Besides the project officials, resource persons were also brought in for the conduct of such workshops.

1.1 Training on Accounts:

Aimed at creating a trend in Nagaland, whereby every village begins functioning as a Non-Banking Financial Institution with the existing village set up. The village functionaries were trained to maintain proper accounting system in the project villages. Accordingly AFPRO (Action for Food Production, Delhi) and NEPED jointly conducted a series of trainings on accounting across the state from 2nd to 19th February 2004. In this first ever formal training on accounts to the villages' simple and easy methods of accounting systems like the use of single column and double column entries in cash book was imparted to the village functionaries. The training was followed by a follow up programme, a review of the accounts training was conducted through a workshop after a gap of six months, in all districts of Nagaland. The village functionaries were trained in the following:

a. They were trained with an option to use either a single column or a double column system.
b. While making entry, all possible information viz. name of register, page no, receipt no., house no., amount, s/o, activity and date to be mentioned to avoid any default.
c. Detail training on the use of both the Receipt & Payment sides in the cash book
d. In case of reconciliation of bank statement, the VDB Secretaries were trained to make all entries correctly for comparison once in a month.
e. In regards to reporting to the concerned authority, they were trained to separately list all the particulars in both Receipt & Payment for final compilation according to sub-heads.

1.2 District level Experience sharing workshop

District level experience-sharing workshop was conducted successfully in all the district headquarters during July and August 2005. Each village functionaries/representative/farmers were made to present the state of the project in their respective villages. The farmers were made to share their experience with the project activities viz- Revolving fund, field

implementations, recovery status, recycling of the recovered amount, SHG formation, SHG activities, savings and success stories.

In all the workshops the resource persons among others, included the district administrator/ Deputy Commissioners /Addl. Deputy Commissioners and district Officers from the Agri. and Allied sectors. The workshop focused its theme on proper implementation of the project. A prominent issue raised by many of the villages has been the issue of finding market for the cash crops that they have taken up. The project team apprised them that as long as there is bulk production, farmers need not worry about market, and that unlike in the past, the project is aware about this problem. The farmers were also assured that the project was ready with certain market linkages for some crops under the projects.
The project members during these workshops asked the village functionaries to update records and document the progress of field activities of the project pertaining to beneficiaries/loanees in their respective villages. The project members impressed upon the participating district officers and the district administrators the need for better coordination between them and the village functionaries and the farmers at large.

Except for some stray cases, no gross violation of the Project mandate has been noticed as far as the project villages were concerned. However, a strict dictate was sounded during these workshops, that any village found misappropriating the project fund, the mortgaged items would be seized and the project withdrawn from the defaulting village.

1.3 Empowering the community:

The process of field verifications of both project site and mortgaged items are correctly and legally in place after final selection of beneficiaries. For project implementation the ideal is to visit all the project sites by the project members, but due to time constraints and the increasing number of loanees it was not practically possible. Therefore, random sampling method was followed. During their visits the project members tried to ascertain and ensure that the loanees were involved in the work for which the loan advances were given and also provide technical supervisions.

Based on this constraint, the village functionaries were empowered to organize field trips on their own to check the activities of the farmers. The activities in most cases include cash crop cultivations, tree plantations, and fisheries. The village functionaries in such visits encourage their fellow farmers. In case of new developments or some default, the village functionaries made it a point to report during the field visit of the concern project members.

The project members during the field trip to the villages help the village functionaries in preparing legal documents pertaining to loans and collaterals. These documents helped empower the village functionaries to have the legal authority and also create a sense of ownership over the project.

NEPED members in such visits make clarion calls to all the beneficiaries for proper utilization of funds, making it clear that in case of failure, the release of the consequent instalments would be stopped. The village functionaries are authorized to seize the mortgaged items of defaulting farmers. This empowerment considerably boosts the level of participation and enthusiasm of the village functionaries.

1.4 Dissemination of Technology by SARS team

1. Research findings of jhum intensification, fallow management, soil conservation etc were disseminated in the form of IEC materials and radio talks such as Arhar as a strip cropping, homestead garden as a sedentary farming, economic tree species of Nagaland, Tithonia as a mulch, use of common salt as weedicide and farmers perception, tea cultivation an option for jhum, management of plant diseases, alder as

a shade tree in tea cultivation, medicinal plants of Nagaland, package of practices of spices and condiments, management of insect pests .

2. Research posters of trial results like performance of different varieties of TPS tuberlets and seed tuber for potato production, effect of various substrates on the production of *Pleurotus sajor-caju,* fallow management in short jhum cycle using Tithonia, soil conservation using physical and live barriers, tuberlet production using TPS, different methods of weed management in jhum, date of planting of potato as influenced by different moon phases, extension of cropping period through inclusion of legumes, control of thatch grass, economic contribution through homestead gardens, characterization of upland paddy cultivars, economic assessment of dual culture of paddy and fish were prepared and used during training programmes.
3. Farmer to farmer cross visit (inter-village and inter-district) were also organized where a large number of farmers took part.
4. SARS conducted 3 days PRA training to field staffs of Agri and allied departments.

Farmers training on JI and FM were also conducted at Mokokchung, Wokha and Tuensang.

2. LESSONS LEARNED:

2.1 Transect and rapport building

In preparing a micro plan for a village, it is imperative that the resources or the requirement of the villages is understood in its proper perspective, for this-

1. Transect of the village is peremptory. During the 'transect' one has to be open and inquisitive without prejudice. Ask questions about all that you see, while answering questions, several insights would be revealed.
2. Drive ahead of the scheduled time, take a walk in and around the village and in the field and ask questions, such as the health of the crop, the yield expected, whether it would be sufficient for the family. Whether they face problems about pests and diseases if so what are the remedies etc. what they did about it and so on.
3. The importance of rapport building needs to be emphasized
4. Interview individuals as one meets them and take note of what he/she thinks about the subject. This would become a source of information in the process of triangulation
5. Always avoid a benevolent attitude so as to prevent the villagers in treating you as a 'giver'.
6. The lesson learnt from the field visit to Balaji Thanda village and the informal interview held with the bonded labourers prior to undertaking PRA exercise during 22nd Sept. to 3rd Oct 2002, was rewarding. This experience enabled the team to focus on the subject using appropriate PRA tools and criteria.

2.2 Market survey and information:

Three POU Members attended a workshop on " Export Basic", conducted by ACCENT of Bangalore at Guwahati on 26th Oct 2004. The lessons learned from this were shared to the other members through a debriefing workshop. The three-member team also established institutional arrangements with Spice Board of India, TRIFED, NE Chamber of Commerce and APEDA. The project through this institutional linkage organized a one-day workshop with a resource person from APEDA on "Market Linkages" pertaining to NEPED crop menu.

A "Marketing Cell" within the project establishment has been created and will involve in reconnoitring market potentials of the project-listed crops.

2.3 Market survey to West and South India

Ten POU members led by the Team Leader undertook a second study tour to South India, during September 2002. The main purpose of the Tour was to explore market for agro-

produce, b uild l inkages, and i dentify commercial c rops, value addi tion, pr ocessing and packaging. In the abs ence of m arket infrastructure, t he N aga f armers hav e be en l imited t o kitchen l evel pr oduction rather t han v enture i nto bul k pr oduction d espite t he existing potentiality.

Focus at the Indian Institute of Packaging (IIP) t he t eam v isited M umbai. T he IIP pr ovides consultancy, training, education, and testing and information services on different packaging for various commodities: agro-based or industrial products. Keeping in mind that Packaging is the first input for marketing, the visit was timely and eye opening. The team visited Bombay Natural History Society (BNHS), Mumbai, which visions on conservation of birds and their habitats as part of bi o-diversity in India. It was quite relevant for the duo to interact, since NEPED al so addresses environment and its preservation. The team then visited Mumbai APMC. The APMC regulates market for agro-produce, provides warehouse, market yards and other infrastructure.

The T eam v isited t he Karnataka S tate Agricultural M arketing Board a nd i nteracted w ith t he Board on issues like: grading and standardization of produce, regulation of market, subsidy to the po or, f ree transport for t he not ified agr o-produce et c. The T eam al so i nteracted w ith t he APMC, Bangalore and also went on a field visit of the APMC. One striking visit was that of the Alanka M arketing Y ard, Bangalore. T he M arketing Yard w as an or ganized s elf-contained complex for farmers to sell their products. The entire facilities such as go-down, weighing scale, security, telecommunication, free transport and regulation of market price have been provided within t he m arket y ard. T he v isit c ulminated w ith a v isit t o the S pices B oard, M inistry of Commerce, C ochin. T he i nteractions w ere m ainly o n m arketing as pects and the v arious packages of schemes available with the Spices Board. Having evinced interest in our project initiatives, t he S pices B oard of fered t o as sist t he P roject w ith funds f or t he development o f nursery to cater to 600 ha of cardamom plantation in the State.

The results from both the study tours have been quite a learning experience. At the end of the tour, every POU admitted that it was one of the most rewarding trips, which opened up a wide variety of challenges and avenues for each POU to boldly venture into.

3. Other Capacity Building Activities:

1. A group of a four member team from Cambodia accompanied by a Dutch couple Hanneke Meijers and Tonie Nooyens, Consultants from the Ratanikiri project, visited NEPED Project on an exchange study tour from 1st to 9th Sept 2001. The couple also conducted a five-day workshop on "Sustainable Livelihood Analysis" facilitated by NEPED and SARS w.e.f. 10th to 14th of Sept. 2001.

2. The G overnment of N agaland under t he ae gis of t he de partment of P & A R, Nagaland Legislative Assembly, Administrative Training Institute and NEPED organized training cum-workshop on Participatory Approaches (PA) at ATI, Kohima from 24th-27th Feb 2004. The Government of N agaland an d N EPED j ointly s ponsored t he t raining c um-workshop. Resource persons from the LEAD, India and NEPED jointly facilitated the four-day training workshop. T his t raining c um-workshop w as ai med at s ensitizing t he p olicy m akers l ike-Ministers/MLAs, S ecretaries, D irectors, m iddle a nd f ield r anking of ficers on embracing participatory approach in the process of implementing developmental programs. Apart from government f unctionaries, s ome l eading N GOs f rom N agaland w ere al so i nvited t o t his training cum-workshop.

3. The project interacted with Spices Board of India and confirmed the sanction of 10 Units of Large Cardamom Certified Nursery Scheme for NEPED. The pr oject accordingly distributed t he s ame as follows - State Agriculture Research Station (4 Units), Wokha (4 units) and Meriema Jhum Improvements Model (2 Units). A visiting officer from the Spices Board of India explained the various techniques for raising cardamom nursery.

4. NEPED facilitated the 3rd National Training Session for LEAD India Associates-Globalization–Regimes and Trends in Agricultural Sector: Opportunities and Challenges for Nagaland in January 2004. The project also facilitated a Lead fellow in presenting the findings and recommendations of the training to the Governor, Council of Ministers and the HoDs in Nagaland during Feb 2004.
5. One POU member participated as Resource Person at the ICEF meet on Renewable Energy, "the way forward" at Kolkata in Sept 2004. The effort made so far by NEPED was screened during the Workshop.
6. Two project members attended a Seminar on the 'concept and philosophy of SHG' and 'Maintenance of Account and Book keeping'; as resource persons. The Seminar was conducted by Department of Wastelands Development, Nagaland.

A. INCREASED RESEARCH OR ADMINISTRATIVE SKILLS OF THE RESEARCHERS INVOLVED

1. Capacitate project members on Participatory Rural Appraisal (PRA)

IDRC project being a research project, the initial stages of the project dwelt on institutional reinforcement. Its members were updated through trainings and workshops on various research tools and skills. One such reinforcement was a six-day PRA workshop which proved effective and vital to its members throughout the project period. The workshop, conducted by PRA during 18-23 June, 2001XIS, capacitated the members on participatory approaches while implementing project activities. Bottom-up and flexible approach was some of the methodologies learned during the workshop. Through this workshop, the project team was introduced to the usage of PRA tools like Resource Mapping, Social Mapping, Seasonal Calendar, Matrix Ranking, Time Line, Historical Transect etc. The resource map, besides the other tools, took centre stage while carrying out project activities. In the course of the implementation of the project, necessity of a resource map for each of the project village emerged based on the fact that the-

- Resource map would serve as an indicator of progress in the resource scenario of the project villages at the end of the project.
- Resource map would provide information on availability of resources while micro planning.

Later in course of the project period each project member conducted resource-mapping workshop using participatory approaches in all the project villages this exercise was done by spending nights out in the villages during their field visits. The resource map of each of the 105 villages was finally documented with the active participation of the farmers.

2. Training in land treatment

A POU and DSU member, along with a farmer from each of the eight different districts of Nagaland, were trained in land treatment measures for a period of five days at Nalagarh, Himachal Pradesh, during Sept 2001. The team also visited Dr. Y. S. Parmer University of Horticulture and Forestry, Solan, and got acquainted with seed preservation and Floriculture. The land treatment method practiced in the arid geographical condition of Nalagarh was found to be not applicable in Nagaland condition.

Nevertheless, the team learned an interesting technique of harvesting and conserving rainwater. The water so conserved is utilized during winter for cultivation of 'rabi' crops and irrigating uncultivable land for crop production. The farmers are replicating the technique in small pockets of their fields.

3. Participation at the International Thematic PRA Training Workshop:

A project member participated in the 6th International Thematic PRA Training Workshop from

22nd Sept to 3rd October 2002 at NISIET, Hyderabad, organised by PRAXIS. The NEPED participant took part in the Micro Level Planning Module. For practical field exercise, the participant with three other trainees made a case study of the Bonded Labourers at the Balagi Thanda village in Andhra Pradesh.

This learning on Micro Level Planning through participatory means was disseminated to the rest of the project members. The planning technique assimilated from the workshop proved effective to the project process.

4. Training in Soil and Water Management

4.1 Study tour to Sikkim:

The project team conducted a tour to Sikkim, from 26th July to 3rd August 2003, to study the land use practices by the farmers of the State. Sikkim is a major producer of cardamom in the country. Since the project is promoting cardamom and ginger as a major cash crop, it was a great learning experience to see first hand of the practices in the production of Cardamom both in the farmers' field as well as at the Research Centres.

Feedback from the project farmers who went on tour has been very encouraging.

- A farmer from Goching village, who was also the Village Council Chairman, regretted that his village had not put sufficient area under cardamom. He was determined to motivate his villagers to put more area under cardamom plantation with or without NEPED fund. After this learning and experience he influenced the village council to pass a resolution that each household in his village would invest on cardamom plantation.
- Most of the farmers opined- if Sikkim can produce cardamom in a large scale under a more difficult topographical condition, Nagaland has better advantage to produce more of the crop.
- Observing the easy market access of cardamom it allayed the fear of the farmers towards cardamom plantation. Ripple effect is anticipated.
- The farmers absorbed elementary know how on management of cardamom plantation and nursery, the operation of curing unit and quality control measures.

4.2 General Green House Management:

Nine project members attended training on General Green House Management at Horticulture Training Centre, Talegoan Dabhade, Pune during 20th -23rd April 2004 Pune. The basic aim of the training was to learn the Green House technology and explore the possibility of replicating it in our climatic condition. The demand of flowers is on the rise not only in India, but also throughout the world. Looking at our climatic condition, it is favourable to grow flowers that have high International market demand. This can also be applied to seasonal vegetables that can be grown throughout.

4.3 Study tour to Udagamandalam:

The POU team consisting of ten members went on a study tour during 9th to 25 Sept. 2002 to Central Soil & Water Conservation Research & Training Institute; Udagamandalam (Ooty) to learn the state of art practices on the watershed management and land treatment measures. The demonstration plots at the Institute were found appropriate for learners from Nagaland because the Nilgiris Hills have similar terrain and biodiversity as Nagaland. However, the measures demonstrated were observed to be rather expensive for the farmers of Nagaland to adopt. Some of the low cost Eucalyptus oil extraction could be replicated in the Nagaland farmers' field as a part value addition processes. During the field interaction the Team learnt the following:

- From the lessons learnt in Ooty, it is suggested that, to go for bulk production, following a bottom up approach in the initial stage of planning. By adopting PRA method, any project could be sustainable.
- Puerto-Rican style of terracing using hedge grass is very impressive; also plantation of tea on the contour bunds has not only controlled the topsoil flow, but also contributes a subsidiary income.
- Scientific method of vegetative terracing and land use in Ooty reveals the following:
    - Recommended slope: 16 to 28%
    - Using vegetative barriers at the outward terrace
    - Guatemala grass, Weeping Grass, Napier Grass etc were used as hedgerows.
    - Intercultural operation was done along the slope.
    - The area of the riser slope is also used for crops.
    - Tea is planted in two rows on risers and the terraces are used for other crops.

5. Other Capacity Building Activities

1. A Workshop with Mr. Fred Carden and Ms. Liz Fajber of the IDRC, Canada was conducted from 18th – 25th July, 2006 to establish Outcome Mapping, which includes -
    a. Self-assessment
    b. Performance measurement
    c. Making of indicators and
    d. To analyze risk factors
2. Two POU members, on invitation, participated in the "Experience Sharing Workshop" at Khajuraho, M.P. w.e.f. 10th to 14th Sept 2001, organized by "The India Farm Forestry Development Cooperative Project", New Delhi.
3. Mr. Khekiye K.Sema, IAS, Secretary Agriculture and the then Team Leader, NEPED, attended an invitational Workshop at Chiangmai, Thailand on: Advance Community Forestry Innovation and Experience organized by RECOFT; from 25th- 28th Sept 2001.
4. One POU Member attended a three week International Training Course on "Participatory Research and Development", at Los Banos, Laguna, Phillippines w.e.f., 24th Sept to 12th Oct 2001.
5. Five POU members attended an "International Workshop on Community Mobilisation for SHG Formation and Economic Activation" at Varanasi, Uttar Pradesh from 21st to 28th Sept 2001. The workshop was orgainsed by International Institute of Development Management Technology of Asian Society for Entrepreneurship Education and Development (IDMAT- ASEED).
6. Two POU members on invitation attended the American Evaluation Association Annual Conference at St. Louis, Missouri, USA wef. 5th -10th, Nov 2001. At the Conference, they presented NEPED and the use of "Outcome Mapping". The duo also attended during the Conference, courses on Professional Development in "Multi-site and cluster evaluation" and "Participatory Evaluation" After the AEA, Conference, the two POUs also attended an interactive session on Outcome Mapping held from 13th -18th, Nov 2001 at the IDRC Head Office in Ottawa, Canada.
7. Five POU members went on an exchange study tour on "Community Based Natural

Resource Management" in Ratanakiri, Combodia from Dec 6th to 18th 2001.

8. Two POU members at the instance of ICEF attended a conference on Participatory Forest Management in India: A move towards Multi-Stakeholder Partnership, organized by TERI on the 8th - 9th Aug 2003 at Hotel Royal Orchid Park Plaza, Bangalore.
9. The Team Leader and one POU member attended an international workshop on Small Hydro Power Development at Trivundrum during Nov 2003.
10. Two POU members attended the 7th international Thematic training workshop on PRA at Thrissur, Kerala.
11. Two POU members attended the ICEF workshop on Experiential Sharing workshop at Bangalore during 2003.
12. 11 POU Members attended an international Seminar on "Hydroger for Today" sponsored by IN-SHP/UNIDO/IEA at Hangzhou, China from 1st -13th Jun 2005. The group also were trained on "Development & Productive use of Pico/Micro Hydropower". The team was also guided to site appraisal on Pico/Micro/Small Hydropower generating stations and Industry, the team tied-up the setting up of UNIDO programmes in Nagaland.
13. Four POUs attended an International Training workshop on Small Hydropower at Kathmandu, Nepal from 8th -11th July 2005 organised by IPPAN, AEPC, IC-SHP, GTZ/SHPP, SHDAN, ICIMOD and WINROCK International. The workshop was sponsored by the Norwegian Embassy and USAID.
14. One POU member attended a workshop in ICIMOD on "Bio-Diversity Conservation" at Kathmandu, Nepal.
15. Two POU Members attended a workshop at Hyderabad on "Community Action for Property Rights"
16. One POU Member attended workshop on biodiversity organised by ICIMOD, Kathmandu, Nepal, on "Access and Benefit Sharing".
17. One POU Member attended a workshop at Uttaranchal on "Facilitating Formation of State Biodiversity Board and Bio-diversity Management Committee" conducted by G.B Pant Institute and National Bio-Diversity Agency

5.1 Other related Activities

1. Julian Gonsalves– Documentation of NEPED Resource Book-II, identified the weakness of NEPED in documentation and proposed to have a writing workshop. Advised NEPED members, areas for collecting materials with tentative topics for the Resource Book, Posters, Pamphlets and leaflets.

B. CONTRIBUTION TO CAPACITY-BUILDING OF WOMEN

1. Capacitating and empowering women:

Traditionally, women's role in agriculture is such that most often, women work behind the scenes doing all productive and back breaking works that goes unnoticed and unaccounted for. Women do not usually participate in village meetings, as they remain pre-occupied with many activities. Sometimes men folk do not share information with women or women themselves are non-participatory in meetings due to lack of confidence or courage. In order to make women's participation in the Project measurable, transparent, realistic, and sustainable, NEPED had emphasized formation of women into an "organized" SHGs with monthly "thrift saving" and engaged themselves in land-based income generation

activities.

Consequently workshops were held with women and the village councils in all the districts during 2004. The outcomes of these workshops have been satisfactory. Some results of the workshop are as follows-

- Awareness created so that the women make sure they get their legitimate 25% of women's share under Revolving Fund
- Even though women are still not included in the customary and traditional governance structure of the villages, the village councils have realized the need for women's participation in the development and planning process.
- With the resource base created under NEPED, the existing women institutions, the *Women Hoho* (women organization) were strengthened. In villages where no such institution exist women were encouraged to form.
- More number of Women Self -Help-Groups formed to judiciously utilize Revolving Fund.
- The traditional institutions of women in the village broadened their horizon beyond labour exchange'

1.1 Workshop feedbacks from the women:

1. Women of Kohima district said that no department in the government has ever conducted such type of workshop in the villages. It was the first of its kind that has created awareness amongst the women.
2. Women folk from Mokokchung district requested NEPED officials to conduct more of such workshops in future so as to motivate them in various fields.
3. Tuensang district women appreciated the project members for conducting such workshop at their doorsteps, which has motivated them. After the workshop they expressed greater confidence in their capabilities to work and earn.
4. In Mon district the village authorities themselves encouraged the women to purchase land for NEPED activities.
5. The examples about the women SHGs activities showcased in south India impressed participants from Phek district who got determined to emulate such examples.

2. Experiences and Lessons learned:

1. Introducing a new idea of organizing women into SHGs was a challenging venture initially. In some village, village functionaries did not readily accept the idea. In others, it was resisted by women themselves as they were not used to having such smaller women groups. Village having strong women society at village level feared that introducing smaller SHGs might disintegrate the women society at large (village women society). This was however, overcome by having separate meetings with women society/ church women and identified women key leaders to initiate SHGs.
2. Some Village authority (VC/VDB) feared that introducing more women SHGs might tape all external funds meant for the general as well. As a result, some village adopted resolution restricting only certain SHGs to exist example, Phekerukriema of Kohima district. However, village authority was sensitized keeping in mind, the long-term benefit of women SHGs beyond NEPED project.
3. In some village, women themselves did not come forward due to ignorance/ illiteracy and shyness. This is also due to lack of local leaders to motivate peers.

4. Women SHGs have inspired formation of male and mixed SHGs groups. About ten such groups have been formed under Kohima and Peren districts.
5. After women were organized into SHGs, women's participation in village meeting has shot up. In some cases, women out numbers males in village meetings.

2.1 Women study tour to Khonoma village:

As a continuous process of forming SHGs, a 46-member women group was taken to Khonoma village during Sept 2004, to share their experiences towards income generating activities. In the village, SHGs formation and thrift saving have become a "village movement". Khonoma women are now seen to be more secured and confident with a sense of ownership, as each group has a considerable amount accumulated in their SHG's bank account and continue to work in land-based income generating activities. After sharing of experiences and interaction by different SHG members, field visit to cardamom fields and nurseries was also organized.

Cardamom Field Visit:

In the first field visit, SHG members from participating villages were taken to cardamom field site for "on the spot" interaction, discussion and clarification. Cardamom suckers planted in 2001 under alder trees were bearing fruits then. Cardamom farmers in Khonoma have said that NEPED had done all the ground works to boost Cardamom cultivation from 2000 onwards with technical support. Seeing cardamom plantation becoming a " Village Movement", Horticulture Department visited Khonoma in 2002 followed by the Spices Board, India in 2003.

Interaction and feedbacks:

It is reported that there are 31 SHGs in Khonoma village comprising of 334 women. Most mothers and adult women in working age have been mobilized into SHGs except some aged-women. 40% RF is utilized by women SHGs as recovery is better from women". All SHGs in this village have linkage with banks in Kohima district. These SHGs can avail bank support for bigger project even after NEPED ends"

"This study tour was a good experience for self improvement. We should have more forums to share experiences within and outside the state too. Sharing among 31 different SHGs in Khonoma is not happening in many villages. However, NEPED had brought many SHGs together through this study tour for interaction and learning together".

The SHGs were shown smokeless "hearth" using bricks and outlet pipe that consumes less firewood and contributing to good health. Each household can adopt this practice to conserve firewood.

"Some terrace fields have been submerged with water to suffocate insect-pests and to control weeds in the field. These fields are meant for cultivation of garlic in September month". This study tour proved to be very useful for all participating SHGs for which more field visit and experience-sharing tour in future may be provided.

3. What people said about women SHGs:

1. Formation of SHGs has contributed to our "village unity and cooperation". Women are spending their time more judiciously for economic development and "no gossip". – Kose Secü, RF Manager, Khonoma.
2. Selhu Terhüja, SHGs Coordinator, Khonoma said, 314 women (mothers and adult women) have organized themselves into 29 SHGs at Khonoma village. Asked if there are still some women who could organize themselves into SHGs, "there are still some but most working age mothers and adult women have formed into SHGs except some aged-women". He further said, about 40% Revolving Fund is utilized by women SHGs at Khonoma as recovery is better from women.

3. Zenei Krotho of L. Khel Kohima said that "as an individual, we tend to be lazy; we planned to do something and we do not execute, but as a group, it is so dynamic that we can not afford to be lazy. For example, if the group decides to do something, we have to obey. We invested Rs.5000/- for procuring ginger rhizome (*vüchü)* and we sold about Rs.13,000/-. SHG formation is good because we involved our children in agricultural activities during their holidays and vacation. Hence, learning to work and value of work culture is promoted among the younger generation."
4. Khouvie Krotho of L. Khel Kohima said that they have a saving of more than Rs.50,000/- in their SHG bank from agricultural activities. This group envisioned to buy land and construct a house.
5. Kerhe SHG said, after Village Council banned killing of animals, "*Kipfü"* is eating up all passion fruit including unripe ones, incurring a heavy loss on this SHG. So the group started nipping the tender shoots for sale. Income incurred from the sale of the tender shoot though low as compared to the fruits, it has however kept the SHG running.

4. CAPACITY-BUILDING FOR RURAL FARMING GROUPS:

Rural Nagaland largely consists of marginal farmers engaged in subsistence farming through jhum. The intent of NEPED is to bring about a paradigm shift from subsistence agriculture to commercial scale production. The result and impact of this focus is becoming apparent in the cropping and production pattern in respect of some selected crops. However, to achieve this modest but significant shift from subsistence farming to large scale production, sensitization and capacity building of the rural farmers was taken as one of the major thrusts of the project. Considerable amount of such exercises were put in.

4.1 Instate field exchange visits for selected farmers

Two project Members and 23 farmers visited organic passion fruit farming at Tadubi, Manipur, on 25th March 2003. This farm is being managed by a farming society involving 954 farmers.

5. Lessons learnt

During this visit farmers learnt two vital techniques-

- Bee keeping along with passion fruit farming has great potential as the passion fruit plant flowers almost through out the year.
- Preserving certain selected tree species like alder, this provides live post for passion fruit vine in addition to conserving and enriching the soil.

After this trip most of the farmers started to replicate this technique back in their farms. Later the feedback was that the bees provided additional income. Preservation of certain tree species in the passion fruit farms prevented the farmer from cutting down trees for posts of the passion fruit vines.

5.1 In-state farmers' exchange visit

Depending on the type of cash crop opted in the micro-plan; each district was earmarked to be equipped with minimum requirement of Processing Units. Accordingly, the project members during 25th to 28th June 2002, led a group of cardamom farmers from Sapotimi village under Zunheboto district to a Pfütsero based cardamom dehydrating unit under Phek district. They were exposed to the functioning of the unit and also to enable the farmers to interact with the Sub-divisional Marketing Board. The farmers from Sapotimi, had a careful observation and went back with first hand information on operation of a dehydrating unit.

The farmers were also made to visit a locally made cardamom drying unit (Bhatis), making them observe the process of how moisture content in cardamom is reduced and later transferred to an electronically operated drying units.

5.2 Sapotimi village visit

In the perspective of motivating the farmers and to broaden the horizon of their thinking on the long-term prospect of agro-forestry, NEPED conducted an exposure visit to Sapotimi village of Zunheboto district, with a 14-member team of farmers drawn from 5 districts of the state.

Sapotimi, is a village fully engaged in cardamom plantation. The Village Council has passed a resolution making cardamom plantation mandatory for every household. Since then, the area under jhum cultivation has significantly reduced. The concept of agro-forestry being practiced in this village has become a role model for other project villages.

The visit was an eye opener in many ways for the farmers. They were especially intrigued by the fact that out of 87 households in this project village, 76 families were involved in cardamom plantation. What was more amazing for the visitors was that the jhuming in this village was almost non-existent, having cultivated an area covering the sowing of 20 tins of paddy by the whole village put together. Their paddy requirement was procured from the rice-producing neighbouring villages with their income from cardamom sale. With the reduction in the labour-intensive jhuming system, the Sapotimi villagers found time to invest their interest in another crop - passion fruit. Here too, 50 households have started cultivating this fruit and they have started a cottage level passion fruit juicing and bottling unit in the village, employing 6-8 workers.

The Village Headman proudly explained to the visitors that this mini plant was established through VDB grant-aid fund and that the cardamom-drying unit was funded by NEPED project. He also explained that their village was able to develop a marketing nexus due to the involvement of the whole community in the production of both cardamom and passion fruit and thereby produce the crop in commercial quantity. Individual effort, he expounded, was less worthwhile in a commercial setting. The visitors appreciated his wisdom and the level of transparency and collective cohesion within his community. It inspired some of them to become permanent cultivators of cardamom and passion fruit.

5.3 Visit to Khonoma and SARS Mokokchung

Khonoma village

Drawn from amongst the Project villages of Mon, Zunheboto, Tuensang, Wokha and Kohima districts a guided study tour was conducted for 18 farmers from 20 to 22nd Sept 2005, to the unique *alder* based jhum-farming system of Khonoma village under Kohima district. Three POU members and two local farmers from the host village facilitated the study tour.

The visiting farmers had the opportunity of interacting with the farmers of Khonoma village on a one to one basis. The farmers acquired an insight of cultivating cardamom under *alder* tree. Farmers from Tuensang became determined that they would also introduce *alder* in their cardamom plantations wherever possible and plant other soil-rejuvenating tree species know to them (particularly *Schima wallichii*), in such areas where *alder* cannot be grown. The participating farmers gained added insight in the viability and sustainability of *cardamom* and decided to invest in cardamom plantation on a commercial scale from the next season. This has been noted by the POUs for cross-reference later.

Though *alder* grows abundantly in the other districts too, the unique usage of this tree by the farmers of Khonoma was a totally new experience for the visiting farmers. They were highly taken in by the systematic method adopted here. The farmers not only realized the diverse benefits and advantages derived out of Alder tree in terms of soil fertility, fire wood extraction, but above of all they appreciated the permanent nature of Jhum terraces developed around it.

Besides cardamom, the primary forest of Puliebadze range impressed the farmers. They drew a conclusion that the villages around this mountain range preserved the forest not only for their traditional method of permanent terrace rice cultivation, but also was a reinforcement of the

system of semi-permanent jhum cultivation through *alder* tree culture.

SARS Mokokchung Visit (Farmers' exposure trip)

In order to enhance farmers' knowledge on jhum intensification and agro-based activities and also to enable them to inculcate innovative ways, the project members guided a 14-member team of farmers from five districts viz. Kohima, Phek, Dimapur, Mokokchung and Wokha to the State Agricultural Research Station (SARS), Mokokchung, during 25th to 28th June 2002.

During the trip the farmers were introduced to activities of their choice in agro-forestry. At SARS their interest were drawn towards:

Tea cultivation: Given the opportunity, they showed willingness to learn more about tea and to start tea nursery and plantation of their own. Their concern however, centered on insufficient funding even with NEPED loan intervention and enquired whether the government would also give them a backup. The nodal department dealing in tea has been suitably informed of their query.

- Watershed management: The farmers had very less knowledge about the value of Watershed Management. After seeing the systematic water management initiative at SARS they felt that the same could be replicated in their respective fields. They however, felt that such Watershed Management would require community effort and participation
- Innovative Activities: They were highly impressed with Polly houses culture, producing off-season vegetable under controlled conditions. They were confident that they could replicate this on their own.
- Decided to demonstrate the pest management practice with Marigold plants back in their respective villages as seen at SARS
- The farmers saw for the first time a new variety of pumpkin, which bears fruit in the same 'hill' without its stolons stems spreading sideways. This pumpkin (Bush squash- *Pusa elonga)* was procured recently by SARS. On their request they were given seeds for propagation.

6. Report on visit to Khonoma by cluster of villages

Fifteen village elders from Longsa, Tichipami, Surumi and Sapotimi villages under Zunheboto district comprising of Village Council, VDB Secretary and Council members from each village were taken to Khonoma, from 20 to 22nd Sept. 2005, to see the bio-diversity conservation, agro-forestry and forest management methods. The purpose of this visit was to let them apply their mind and replicate the system in managing the 'Murumtu' mountain range, which is owned by these four Villages from Mokokchung and Zunheboto districts. The following issues were discussed with Village Council and Tourism Society members of Khonoma:

- Forest management and bio-diversity conservation adopted by Khonoma village
- Wild life preservation, regulations for hunting and Cattle/Mithun control
- Herbarium
- Role of women and youth in Natural Resource Management

Village elders from these four villages also interacted with Secretary Tragopan Society, President Youth Organization and Tourism Society of the village. The group discussed on the resolution adopted by Khonoma village on forest and biodiversity management.

- Banned exploitation of forest
- Prohibition of hunting and imposition Rs. 3000 as fine on defaulters.
- Cleanliness and sanitation drive initiated by youth organization by installing 100 numbers of dustbins with success rate 70-80%.
- Under the theme of 'Green village', the Government had sanctioned an amount of Rs. 3 crores.

- Replication of Khonoma's unique alder management by various government departments in other districts having similar altitude.

7. Farmers' Exposure Trips:

As mentioned earlier, exposure trips and tours, conducted both for farmers and the village functionaries by NEPED proved to be a better learning process. This is so because farmers understood things better when introduced to field and ground realities. For instance, an eye opener for farmers was when they were taken to Jhum Intensification demonstration plot at Aosettsu in Mokokchung district. Here, legumes such as velvet bean, soya bean, rice bean etc, are cultivated for soil rejuvenation in a second year abandoned jhum field, to facilitate cultivation of rice in the third year. They were surprised to see a specific jhum plot thriving with rice even in the 3rd year, due to cultivation of legumes in the same plot during the second year. They were impressed with the innovation that could control encroachment into primary forests. Likewise, given the opportunity, they showed willingness to learn more about tea and to start tea nurseries and plantation of their own. They even decided to invite tea experts for technical guidance.

Through such exposures and study tours, the village functionaries, specifically the VCs/VDBs came to understand the practical procedures involved in watershed management, pest management practices, marketing aspects and the subsequent activities involved, they were also highly impressed with the new technique of farming under poly house cultures, producing off-season vegetable under controlled conditions. A fair amount of farmers are now replicating the new technology. The farmers were so much impressed that; their enthusiasm and capacities have been built towards sustainable economic activities and environmental protection.

Summing it up towards these ends, farmers commented that, "we have heard and seen now with our own eyes. When we go back home, with these learnings we will forge ahead towards sustainability in farming. We will share the experiences to our villagers". NEPED too feels that such trips are very vital for all stakeholders.

8. Other Capacity Building Activities

1. Two (2) POU Members were nominated for a workshop at Beijing from 8th -12th May 2002 on SAGA/ for an IDRC coordinated project. Ultimately one (1) POU member attended the workshop.
2. One POU member attended a workshop on SAGA (Social Analysis Gender Analysis) at Kathmandu, NEPAL from 12th – 18th Sept 2004. The trip was fully funded by IDRC and PRGA, Cali, Colombia

One lady POU member attended a workshop on "Vulnerable Women in Rural Areas" at Kaula Lampur, Malaysia during 2004.

9. Capacity Building SARS team

1. SARS team attended 2 Outcome Mappings at Kohima during 2004 and 2006
2. SARS team attended PR&D workshop at SARS office complex during 2006 where Dr. Julian Gonsalves and Dr. Carlos S. Basilio were the resource persons.
3. Farmers training programme on jhum intensification, fallow management, soil conservation etc were conducted in all the three districts headquarters and in the villages as well.

Farmers field days in the trial plots were also organized during the cropping season.

Conclusion:

The existing unique established village institutional set up were strengthened and augmented

the implementation of projects in the villages. The villagers were able to put to use the capacity building imparted for Government Department projects as well. In this they were able to visualise the end product of the project and suggest project activities that suit the local setting.

Timely visit of IDRC officials enhanced the skill of POU for monitoring and evaluation of project sites. The project members' performance skills were updated through trainings and workshops on application of various research tools and study tours to places where similar project activities are established and practiced. By observing the monitoring processes of the IDRC personals, who are professionals in the monitoring and evaluation, the POU members learnt to monitor and evaluate the project implementation in the villages. The PM&E tools used by IDRC were helpful in assessing the whether or not the project was achieving its target. Thus, capacity building of the project team became on-going process with every of the IDRC officials.

The capacity building on and application of Outcome Mapping tools, which includes self-assessment, performance measurement, making of indicators and analysis of risk factors greatly benefited the project team members directly, and indirectly the beneficiaries because the project implementation was more effective. As a result of effective implementation of the programme, farming families were able to enhance their household income level because among others they were able to cultivate the right crop and sell their produces at a better price. While exploring market for agro-produce, identify commercial crops and building linkages, the project members had identified 'lack of market linkage and infrastructure that plagued farmers for long'. These gaps were partly addressed by obtaining right information on value addition and infrastructure for drying, curing, processing and packaging were provided through market surveys.

Capacity building of farmers through hand-on implementation such as negotiating price with the Factory owners, traders and other business houses gave them confidence in establishing market linkages for themselves and the community. By providing opportunities to share these experiences among villagers and village functionaries, the knowledge was disseminated and the farmers became more confident to produce crops that could be sold in the market and improve the livelihood.

Through exposures trips and training a paradigm shift from subsistence agriculture to large and commercial scale production was brought about in many villages. The areas put under the cultivation of crops for household consumption such as Pumpkins were reduced and increased the areas of crops such as garlic, chilli and cash crops that generated cash income.

Most importantly, the communities were able to organise themselves into clusters and groups to produce a certain identified crops such as cardamom and passion fruit and to negotiate the price, control the quality at local level and produce sufficient quantity that could either attract market to the locality or had mass sufficient to hire a truck and transport them to market for sale.

CHAPTER – IV
PROJECT MANAGEMENT

It may be noted here that the programme 'Strengthening Natural Resource Management and Farmers' Livelihoods in Nagaland' supported by IRDC, New Delhi was to start simultaneously with the NEPED-II project in 2001. The idea being that the research results would serve as the precursor to actual implementation in the project sites and villages. However, this could not be done because of the funding procedural delays. In order to get the research fund from the donor by NEPED, the following procedural steps were required:

1. IRDC places fund to the Ministry of Environment and Forests (MoEF), Government of India (GoI),
2. The MoEF records the receipt and incorporate them as part of their consolidated fund and therefore passes through due processes of law before it is distinguished as an earmarked budget for NEPED's programme.
3. After this, the MoEF transfer the fund to the Reserve Bank of India (RBI)
4. The MoEF then issue Sanction Order to the Government of Nagaland through the Department of Agriculture (DoA)
5. The DoA then advises NEPED that it is in receipt of such Sanction Order from the MoEF
6. The NEPED confirms with the Finance Department, Nagaland whether or not the Department had received advice from RBI with respect to the specified amount for the programme
7. Only after the confirmation that the Finance Department, Nagaland had received advice from RBI, NEPED prepares a proposal stating the activities and amount and submits to the DoA, Nagaland
8. The DoA, Nagaland after scrutiny submits to the Department of Planning and Co-ordination, Nagaland for 'Planning Clearance'
9. After receiving 'Planning Clearance', the DoA will request the Finance Department Nagaland for 'Concurrence'
10. The next step is that the DoA will issue Expenditure Sanction Order
11. With this Expenditure Sanction Order the DoA again requests the Finance Department to issue Drawal Authority to the Treasury Officer, Kohima (South)
12. The authorised person in the Directorate of Agriculture will then prepare necessary papers and submits it to the Treasury, Kohima (South) and the amount is drawn
13. On request by the Team Leader NEPED, this amount is then transferred to NEPED account

Only after the above 13 steps are fulfilled, funds could be utilised for undertaking the activities under the programme. The project was designed to start the work by the 1st week of April 2001, but actual receipt of the 1st Instalment was possible only in December 2002. The subsequent instalments also passed through the same procedure.

The project was designed in such a way that the researchers in State Agriculture Research Station (SARS) were to put emphasis on the On-station and On-farm trials of Objectives 1 and 2 of programme, while members Project Operations Unit of NEPED were to focus more on the Objectives 3 to 6 largely concentrating on marketing and value addition; operationalisation of rural micro-credit mechanism, and capacity building of the partners. The point of convergence

between SARS team and POU was timely consultation on issues and technical problems raised by the farmers such as controlling weeds infestation, diseases and pest control, identifying shade tolerant crops for incorporating in the farmers' fields.

Both the teams had the freedom to design its own work plan in line with the project intend and execute as deem fit to fulfill the overall objective. The workplan was approved by the project leader and implemented accordingly. The research results were shared at regular intervals.

The technical and administrative support provided by IDRC was participatory giving emphasis on the local needs rather than imposing its mandate. This flexible approach of IDRC was its core strength that enabled NEPED to largely fulfill the objectives of the project despite the procedural delay in the release of fund by the Government. The timeline set in the original project proposal became redundant and therefore, the NEPED project team was compelled to innovate and identify the need of the hour and prepare work plan accordingly. As for instance assessment of poles from trees planted in NEPED – I was scheduled to be done in the intial years of the project was delayed till 2005 and could be carried out when the Government of Nagaland requested for it. In other cases like assessment of cost of production for 'menu crops' could be carried out when farmers had high expectation without understanding the market forces at play and they were convinced to sell their produce at good price. Providing timely assistance for transport to sell the farmers' produce especially ginger during 2003 had a far reaching impact.

The IDRC facilitated training both within the country and abroad had improved the performance of the team members. Special conducted studies such as Social Analysis/Gender Analysis (SAGA) sponsored by IDRC increased the gender sensitivity among the project team members so that they were able to engender the project activities in implementation.

CHAPTER – V
IMPACT

I. NEPED's CONTRIBUTION TO THE TRANSITION OF AGRICULTURAL PRACTICES AND GOOD GOVERNANCE IN NAGALAND

1. Bringing about Farmers' transition from subsistence agriculture to market economy

The NEPED project had contributed to the transition from subsistence agriculture to cash crop economy in agricultural practices in Nagaland. The most prominent evidences on transition taking place could be examined.

Mohung is one of the NEPED project villages. In 2001 the project team members visited the village to prepare micro-plan. The villagers informed the team members about the potential that existed for expansion of the areas under cardamom and showed evidences that it thrives well in the locality. The team members and the villagers agreed that large cardamom cultivation is the ideal choice for the village. NEPED project facilitated the procurement of planting material as well as financially assisted the farmers for the cultivation of cardamom. It was observed that almost every farming family of the village cultivated the crop, many of them along with the jhum crop. Ngangching, an adjoining NEPED project village, replicated this. In 2002, several farmers started to harvest and sell them at good price which enthused other farmers to manage their plantation better. In the years that followed, the harvest increased and traders came from Assam to purchase cardamom from Mohung and Ngangching villages.

Following the success of cardamom cultivation in these two villages, the Department of Land Resources, Nagaland promoted the crop in a large scale and expanded the areas under the crop in these two villages and also almost all villages in the south east of Mon district locally called 'Upper Konyak' region.

In some villages it is the village functionaries that impose the transition. The village council of Sapotimi in the district of Zunheboto district made a resolution that all the farming families residing in the village should cultivate cardamom and passion fruit. Accordingly, all the farming families had cultivated cardamom. The NEPED project launched its programme just when this resolution was made which strengthened the successful implementation of the resolution. It is reported that only very small area of the village land is now subjected to jhum cultivation. In 2004, the POU member in-charge of Zunheboto district reported that Sapotimi farmers had harvest and dried 12MT of cardamom and were able to sell out the product @ Rs.100/kg to the traders.

Similar to Sapotimi, Bade, a NEPED project village under Dimapur district, for the first time took up turmeric cultivation involving the whole village. In 2002-they could harvest about 47 MT and earned Rs. 1,22,562/- from the sale. In 2003 total harvest increased to 105 MT and earned an income of Rs, 2,79,042. It may be mentioned that in the first year the villagers had problem to sell the produce, since this was their first venture. By the second year, there was stiff competition among traders who came to the village to purchase turmeric from this village. As a result the price increased from Rs. 2.00 to Rs. 3.50/Kg raw, and from Rs. 15.00 to Rs. 17.00/Kg after drying. A new trend on Agro-based business has been established. Recovery of Revolving Fund from this village is also 100% in terms of interest as well as principal. Now villagers are calling turmeric as '*Yellow gold*'

Uniqueness of a local product, turned into cash crop was seen in the case of Leangkunger village when the awareness was created about its uniqueness. Leangkunger is a village located in a remote corner in the district of Tuensang. In this village farmers were producing French beans locally known as *'Kholar'* for home consumptions only. The little surplus produce a family could afford was gifted to visitors who appreciated the uniqueness of its taste. Because

of these little gifts the local name *Kholar* became a trade name and was popular among those who had the opportunity to taste. Demand for *Kholar* began to come in, and so when they realised that their produce could be marketed, they have increased their crop area and now production is high and many traders from other villages and towns come and purchase from the village. It was reported by farmers that in the past, they were producing Kholar sufficient only for household consumption but now the crop is commercialised. Village authority had informed that on an average, each household is producing not less than 30 *tins* of kholar per household, an increase from five tins on an average. All this produce is sold either by private or in groups and shares their profit equally. The demand had increased competition in cultivating kholar and soyabean in Tuensang district and this led to diversification of variety of produce. They have also taken up maize and local potato cultivation in large scale due to heavy demand from the buyers. Now each household member is actively cultivating one crop or the other to earn more income. Agri-business is coming up soon in the villages. This was possible due to the intervention of the NEPED project. With the change of this cultivation system, people are now able to have more time in doing other activities also. They have learnt the art of earning income with less effort. There is a good set up of various committee and groups to take care of the production system. They are able to look for markets where they can sell and earn more.

While the communities have taken initiatives to change from subsistence agriculture to cash crop cultivation, progressive farmers in the villages have also played an important role. For instance, a progressive farmer of Longsa village in the district of Wokha cultivated passion fruit and sold at good price. It took two years of continued production and sale of passion fruit to persuade his wife to drastically reduce the area under jhum and concentrate on production of passion fruit. In the past, this family used to cultivate a jhum area where they sow 16 tins of seed, now they cultivate an area where they sow only two tins of paddy seed. The family also played a major role in influencing the communities in taking up collective action in the cultivation of passion fruit. There is sufficient production from this village, where during the fruiting season, the Agriculture Produce Market Committee, Wokha sends Trucks to collect the produce from the village.

Through collective action in the production of the same item farmers in the project villages were able to find their own market linkages with the defence personal. Banana thrives well in Elumyo village in the district of Wokha. With the loans obtained from NEPED project, farmers of this village went into cultivation of Banana collectively, thereby, transforming erstwhile jhum fields into banana fields. The initial marketing strategy adopted by them was selling them to local vendors, which they did. The product attracted the attention of the Assam Rifles personnel stationed permanently in Wokha, the district Headquarter. The Assam Rifle personals are now their major customer. The farmers have now informally organised themselves, and supply banana to the defence personnel at regular interval, at the same time meet the demand of the local market.

Farmers of Nagaland were able to ingeniously transit from subsistence to market economy using cash crop as via media. This had happened in Ungma and Changtongya villages of Mokokchung district. There is always a heavy demand for pork among the people of Nagaland and the people of Mokokchung district are no exception. Realising this, the farmers of these two villages obtained loans from the NEPED project to fund for conversion of their jhum fields into cultivation of Tapioca primarily to be used as feed for pigs. Part of the loan was used in the purchase of piglets for rearing, and the other part was used for the cultivation of Tapioca. The farmers harvested Tapioca to feed the pigs for six to eight months and sold out at good price ranging from Rs.8000 to Rs.12000 per pig. Part of the sale proceed is ploughed back into the purchase of piglet to continue the rearing of pigs, thus the cycle continued. The underlying reason for this transition is that many farmers had said “It is more profitable to have pigs in the backyard than having a granary.”

In almost all the NEPED villages the transition is taking place, some are less conspicuous whereas, in some cases, major changes. In the villages that are located near the district headquarters and are well connected by road, farmers are more aware of the market forces at play and change the strategy to meet the challenges, whereas, farmers in the remote villages are overwhelmed when the price of the commodity that they had produced crashed in the market.

The need for a fluent and organized marketing system for agricultural products in the State is the utmost importance at this juncture. It is also important to understand the fear- psycho of farmers due to the fact that there are no assured markets for most of the potential commercial crops. Situation has been further aggravated by the failure of coffee & cardamom crops in the past due to the failure of making market information available to the farmers. The handicap in the process of commercializing certain crops also lies with the fragmented land holding system and the hostile hilly terrain. Having such experiences with both Government and the farmers, efforts are still on through various agencies / Departments in developing market network in the state.

NEPED is one of the agencies that are working closely with the farmers in opening market linkage on important agricultural crops. Interaction and discussions with the senior bureaucrats and decision-makers as well as with the private sectors are also being carried out to explore the possibilities of marketing the agricultural produces in the state.

Bade village under Dimapur District took up cultivation of turmeric crop during preparation of micro-plan in the Village under NEPED project in 2001. Consequently, the production came up to about 200 metric tonnes. The produce was sold in raw form @ Rs. 2.00 per kilo. Farmers could not make good profit as it was sold raw without any value-addition. But farmers did not give up because NEPED project was closely monitoring and flashing the progress of Village endeavour to dealers to venture in. During 2002 and 2003, farmers learnt the process of adding value through boiling and drying. By this time Dealers from Delhi and Bangalore arrived at Dimapur to purchase the dried turmeric from this Village. They were offering Rs. 12 per kilo of dried turmeric. Meantime one dealer from Lanka of Assam reached the Village itself and started procuring the product @ Rs. 15 per kilo and since then this dealer is continuing to buy from the village itself and now the price of dried turmeric has reached Rs.29 per kilo. This persistent cultivation despite the partial success in the first and gaining good price in the second year had ripple effect in other NEPED Villages such as Ruzaphema of Dimapur and some villages under Zunheboto District have also started cultivation of turmeric.

Similarly, large quantity of passion fruit have been sold to fruit canning factory at Longnak of Mokokchung, and Nagaland Industrial Product of Dimapur from Districts of Wokha, Mokokchung, Kohima and Phek, through NEPED initiatives. Some women SHGs from Chumukedima village under Dimapur District are selling Bamboo shoot collected from their village forest to Nagaland Industrial Product.

In Tuensang District, Leangkunger and Sangphur villages under NEPED are able to sell their produce of French bean (kholar by local name) and potato outside their village and to other districts in Nagaland. Eg (a) Leangkunger village alone could produce as much as 40 metric tons of French beans from a small village consisting of 119 households. The total earning from the French bean alone was Rs 5,00,000/- @ Rs 12500 per metric tonne.

(b) Sangphur village could sell 18 metric tonne of potatoes @ Rs. 10000 per metric tonne earning about Rs.180000 per season in addition to other crop like kholar which brought them income of Rs. 100000 and of Rs. 21000 from maize in a single year.

During the 5th year, cardamom, passion fruit, ginger, banana, and vegetables such as chilli, soya bean and maize were marketed. In Wokha, about 50MT Passion fruits @Rs 10/kg were marketed through Horticulture department to FTC, Longnak and NIP, Dimapur in 2004. The

produce were kept on roadside and transported directly by the departmental truck. About 78.8 Mt of ginger were marketed to different outlets such as APMCs, Dimapur and to local markets at the rate ranging from Rs 15/- to Rs 25/- per kg. In Mon, the villagers sold ginger to '*Biparis'* at an average rate of Rs.25/kg.

Farmers of Mon villages had started to harvest cardamom that had been planted in 2002. Two villages had estimated that they had produced over 2MT of dried cardamom capsules. The curing is done by traditionally smoking the fresh cardamom capsules over the hearth. During 2004, the APMC Mon had purchased most of the product from the villagers at the rate of Rs. 70/kg and stored in Aboi Collecting Centre. Some farmers were able to sell their cardamom capsule to *'Biparis'* @Rs.75/kg. Tea production is yet to take on, on a commercial scale. A private entrepreneur collected about 15MT of banana from Elumyo village (Wokha) for supply to Security Forces.

In some districts the Agriculture Department had constructed Marketing complex in which Horticulture department and NEPED had supported with equipments such as Juicer for passion fruit and oranges and gasifier for curing cardamom. Farmers from interior village of Chare in Tuensang district arranged marketing their produce and fixed the rate by the village councils depending on the crops. The produce is then brought to Dimapur through trucks and is sold to the buyers.

Collecting Centre for ginger and passion fruits are needed before farmer transports and sells their produces in bulk or in the local market. But so far, no districts have long-term storage facility for perishable commodities. This may be an area to be attended to when commercial scale production start in order to facilitate transport and value addition processes. Since full capacity production has not yet started for most crops, the little that the farmer produces were kept at home and disposed in piecemeal in the local market.

In order to facilitate marketing chain at various levels such as Village and district, NEPED had collaborated with Agriculture and Horticulture Departments for setting up of Village Marketing Committee at village level and APMC at District level. However, there are different levels of performances of these committees based on the locality, manpower and degree of efficiency of both human and material resources. Some committees are doing very well both at the village as well as the district level by creating linkages right from production to the markets. For example, Pholami village in Phek district had started purchasing raw cardamom from farmers this year. This committee will be responsible for curing and marketing the same. The APMC, Wokha had supplied about 20 MT of ginger to farmers in 2004 with buy back arrangements. They have also procured 2 MT of fresh Cardamom @ Rs. 15/kg from farmers. In Zunheboto, a Marketing Board has been formed in the four test cluster villages. Two farmers from each of these villages have been included as members.

As a result of the growing demands on value addition equipments, several trips were undertaken during the project period for market survey and identification of value addition equipments.

After research into several rural technologies available in the market for drying of cardamom, NEPED has also ventured into introducing value-addition activities so as to help farmers in obtaining maximum benefit from low-volume but high value from their products. From 2001-2005, NEPED has introduced and installed as much as 25 numbers of up-draft gasifier under value-addition activities to Villages of Large Cardamom growing areas so as to enable them to dry cardamom. This venture is providing farmers not only value-addition, but also better quality of the product as compared to traditional "bhatti system". In addition, small equipments like juicer have been provided to SHGs for home-scale fruit juicing as value-addition activities.

2. NEPED shows good governance to Government

Most of NEPED project major undertaking and are backed by research with the technical and resource support of IDRC. The result both in terms of success and failure is a showcase to those who are interested in knowing about them. The Government of Nagaland in particular had taken cognisance of the governance in NEPED and had adopted its strategy in its programme. Among these programme are the Bamboo Mission, the Honey Mission and Nagaland Bio-resource Team.

The good governance in NEPED is the result of careful organisational design with multi disciplinary approach with the team members from different line departments, where there is no hierarchy within the team. It operated like an NGO in the spirit of – 'Non-departmental Government Organisation, where every ones view counts and active role playing in the team is the essence of project implementation. Mentoring each other in the field expertise and building on individual strength is another feature of NEPED. Here the Team Leader is the first among equals.

The work culture in the team consists of constant interaction, weekly meetings to share experience, regular documentation of individual and team leading to continual learning curve. Periodic self-assessment as a team and planning together and identifying gaps resulting in prioritization and time bound implementation of tasks have been a regular festive.

In the implementation, the Project follows a participatory approach and based on needs finds out from research undertaken by the team applying appropriate tools and PRA techniques where there is a constant monitoring evaluation that are regularly validated with stakeholders. Every step of implementation taken are on consultative processes and are re-designed if necessary, based on feedback

The over-arching principles are: transparency in all aspects, dissemination and information sharing, being accountable to stakeholders, seeking best options that aim for sustainability. Constant learning & experimentation that leads to enabling others beyond reach of project because it is driven by Vision & Mission statements. The project team members go to the community with an open mind and an attitude that "Farmer knows best".

Observing the good governance in NEPED and its successes, the Government of Nagaland constituted Bamboo Mission, the Honey Mission and Nagaland Bio-resource Team in line with the NEPED project. The NEPED team members became mentors for the teams formed. The RSGY project implemented in the district of Mon funded by the Government of India had replicated the model designed by NEPED. The NEPED model is that: the project village through its Council receives grant-in-aid from the project which loaned to farmers with terms that are easy for the farmers to repay. The farmers repay the loan to the Council, which is again loaned to those who are in 'wait list'.

II. Post project evaluation of NEPED villages

As a procedural delay in receiving funds from the donors, several precursor works such as case study of 'Naga Loan', discussion with village authorities, supply-demand study for crop selection became redundant. In view of this, the unspent amount was used in activities that the project considered to be appropriate and one of them was Post Project Evaluation studies in lieu of 'Naga Loan'.

1. Rationale

NEPED – II was winded up in July 2006. The project was establishing rural micro credit mechanism in the villages, it was important that a continuous monitoring is in place even when the project is not financially supported. It was felt necessary that a post project evaluation of the project villages was undertaken by the project officers to find out which of the villages were doing well and which were not. It was also felt necessary to identify the gaps in case of those villages that were not doing well and strengthen those that were doing well by giving technical support.

NEPED – III came into operation with a set of five new members replacing with only five former members still in place. Exposing the new members to the NEPED-II project was going to be beneficial as capacity building process for them.

2. How the evaluation was conducted

The former members were requested to participate in the evaluation by providing logistic planning and introducing the members to the community. With the guidance from the former members, information was sent to the villages.

The villages were ready when the team members went there. In the process of evaluation books and accounts were displayed and how the community members entrusted with the responsibility of operating the fund explained the process to new POU members. In this way the villagers became the teachers for the new POU members. The summary of the findings in this post project evaluation study is shown in the following Table.

Table: Performance assessment of Revolving Fund operation

				(Number of village)	
District	**Very good**	**Good**	**Total**	**Poor**	**Grant Total**
1	**2**	**3**	**4**	**5**	**6**
Wokha	4	5	9	3	12
Dimapur	6	3	9	3	13
Tuensang	3	4	7	6	13
Mon	3	7	10	2	12
Mokokchung	2	5	7	5	12
Phek	7	5	12	2	14
Kohima	8	5	13		13
Zunheboto	6	6	12	4	16
Total	**39**	**40**	**79**	**25**	**105**

Conclusion

- 'Very good' are those villages whose recovery of loans are or nearly 100% because the loanees are regularly repaying loans which are deposited in Banks and they have fulfilled the objective of the project. They are confident in operating the Revolving Fund on their own
- 'Good' are those villages that can improve to 'Very good' status with a little support from project Officials in the form post project monitoring
- 'Poor' are those villages that are recalcitrant and require drastic actions

Result used

The summary was disseminated to the Government of Nagaland (GoN) to impress them that given the opportunity, most villages are capable and are credit worthy. As a result the GoN had incorporated Revolving Fund in many of its programme.

CHAPTER – VI
OVERALL ASSESSMENT

The project was designed to address the gaps and weaknesses in the main project funded by ICEF. One clear weakness in the main project was that the component of research for development was lacking. It had been the experience that whenever there were problems faced by the farmers, there was no way the project implementers could find an immediate solution. The IDRC project that accompanied the main project was able to address this weakness.

NEPED had been a partner of IDRC and the relationship went a long way back in 1995. As always is a quality of good donor, IDRC's approach had always been flexible, consultative, and interactive and provided good facilitation services. When the project was being formulated during the tenure Elizabeth Fajber as Senior Program Specialist, she initiated consultative processes in designing the project to address the gaps in the main project. As is the case with program officers of good donors, she asked the right questions and solicited the right answers whereby a comfort level was established between NEPED team members and IDRC. As a result we feel that the investment of time, effort and funding involved is much more than adequate.

The NEPED project benefited from IDRC project in many ways. The research capabilities of the team members were enhanced, this, not only met the reporting requirements but also added to the quality of project implementation because by asking the right question and soliciting the right answer, we were able to address the right issue.

The project had a strong component in market intelligence. This component enabled the team members to undertake market surveys and study the cost of production of focused crops and link them to market. As a result market linkage was established between the buyers and sellers and emerged on a win/win situation in crops like Passion fruit and cardamom. However, while the initial thrust of ginger marketing was encouraging, when the production from farmers of Nagaland crossed over 30,000 MT, it was beyond the resources of the NEPED project to handle it dawn on us that we needed a higher level of capacity building.

As a partner of IDRC that has a world wide network, NEPED had the advantage of entering into the network. Through IDRC's network, NEPED's achievements were published and became a 'window to outside world'.

The project enabled the team members to research into the problems faced by the farmers especially pests and diseases and marketing. It enabled us to facilitate the team to have dialogue with other agencies like Spice Board of India, Nagaland University and Nagaland Government's Research Stations to address the problems and also study into innovations adopted by farmers in other villages how they have addressed the problem and transfer the innovative adaptations to the communities that were requiring it.

The capacity of the project team members were increased whereby we were able to formulate and articulate to needs of the people and approach donors to support the activities. One such donor was Sir Dorabji Tata Trust from whom we received support to undertake a project on Strengthening Community Conserved Areas in Nagaland. Other projects are also in the

pipeline.

Dissemination of Outcome Mapping helped us to plan, execute and evaluate our project better. Not only that we were able to use the tool in making Vision and Mission Statement with villages. Facilitating and enabling us through support and logistical arrangements to get trainings on Participatory Approaches had been of immense value.

The IDRC project had increased our capacity in documentation. The documents we have prepared such as the Source Books and other research data were of help to other researchers. We were also able to confidently present our case to the decision makers in influencing the policy. The data we collected through post project evaluation was an eye opener to decision makers that such evaluation was required for other Government projects as well.

While several team members benefited and enriched the Project through exposure trips and disseminated the experiences to the team, there would have been more activities had not been sufficient. In order to keep pace with the developments taking within the region if not globally, it is important that the team members relevant Workshops, Trainings and Seminars. It was felt that IDRC could have facilitated more on this item of activities during the project period.

On the whole the flexible approach on need base, consultative process, facilitation practices and creating an easy and comfortable environment to work with, which is inherent to IDRC, was more than adequate and time investment and the value got was above expectation. We look forward to the continued relationship with IRDC in the present form.

CHAPTER - VII
RECOMMENDATIONS

Implementing ' Strengthening Natural Resource Management and Livelihoods in Nagaland' project supported by IDRC had been rewarding. In the course of implementing the project, the need for further work had come into view:

- Market value chain analysis and certification
  - How marketing was working within the village level and how the produce were sold to the outlets in commercial hub of Nagaland, Dimapur and Punanamai of Manipur State had be analysed and farmers had benefited, which had been reported in the preceding chapters. However, it was observed that having only two outlets for the produces of Nagaland was found to be wobbly and unreliable. It was also observed that Dimapur market dictated the terms and price to the farmers who are without alternatives since they have no avenue to bargain.
    Most of the products from rural Nagaland are 'chemical free' and therefore the traders were taking advantage of it and were making good profit by undercutting the purchase price from rural farmers and selling them to onward traders at good price. This was clear from Ginger trade during 2002 and 2003.
    The emerging need now is to carry out Market and value chain analysis on identified crops and explore ways and means of certification

- Study, documentation and transfer of rural technologies and innovations
  - Broad overview of farmers' traditional good practices, recent innovations by farmers, introduced technologies that were tried out whether adopted to improve livelihoods or rejected by farmers for several reasons, are available. However, critical analysis of good practices, documentation and transfer of rural technologies and innovations is yet to take place systematically.
    There is a need now an urgent need to study, document and transfer these rural technologies and innovations. Research and development are taking place and appropriate technologies are being invented that could be beneficial to the rural poor villages in Nagaland. Exploring these technologies and renovating them to fit the local environment is a promising sector that needs to be addressed.

- Support SARS like research stations in every district run by local experts
  - In the recent years the farmers had started to introduce new crops and technologies within their private fields. It was also observed that some villages are setting up research sectors to investigate into potential crops that could be introduced to enhance the livelihoods standards of the village. These initiatives need technological backstop. Fortunately, there are ' local experts' (knowledgeable rustics) who are through experience are able to advise fellow farmers.
    Establishing a SARS like research stations in every district run by these 'local experts' with scientific backstop from professionals from appropriate field would go a long way in improving the agricultural landscape of Nagaland.

- Exposure trips and capacity building
  - Exposure trips sponsored and facilitated by IDRC to the neighbouring counties during the previous two phases of NEPED had enriched the project in several ways. The

need for this activity is now more profound because the Government of Nagaland had set up Special Economic Zone (SEZ) and dialogues are being initiated with Southeast Asian countries especially with South Korea and Thailand. This SEZ is in consistent with 'Look East' policy advocated by Government of India.

There is therefore a need for the people of Nagaland to venture out and learn post harvest technology; packaging requirements production systems that are acceptable to the consumers in these countries; rural technologies and innovations being practiced by them.

Globalisation had come to stay even in a remote place like Nagaland and there is a necessity to keep pace with the process. The project team members therefore, require capacity buildings in current issues such as : Most Significant Changes, Carbon Trading, Climate Change Mitigation, Piggery production system in Southeast Asia, Rural enterprise and leadership development.

ANNEXURES

ANNEXURE-1

List of NEPED Publications

I. Resource Books

1. Building Upon traditional Agriculture in Nagaland, India
   Published 1999 by NEPED and IIRR- ISBN: 0-942717-72-4

2. Adding Value to shifting Cultivation in Nagaland, India
   Published 2006 by NEPED-ISBN: 978-81-904537-0-5

II. Briefing Papers

1. Alder-Based Jhum System (Khonoma)
   Published 1996 by POU, NEPED

2. Indigenous Economic Tree Species
   Published 1998 by Vizonyu & Zavikhol

3. Techniques In Nursery Management
   Published 1999 by POU, NEPED

4. Wood Products And Marketing
   Published 1999 by POU, NEPED

5. Women In NEPED Project
   Published 1999 by POU, NEPED

6. Environment Activism and Women
   Published 1999 by POU, NEPED

7. Tree Planting By Direct Sowing
   Published 1999 by POU, NEPED

8. Participatory Rural Appraisal and Tools
   Published 2001 by POU, NEPED

9. State Of The Project 'White Paper'
   Published 2003 by POU, NEPED

10. Guideline For Credit Mechanism
    Published 2003 by POU, NEPED

11. Role Of Marketing In Sustainable Economic Development
    Published 2003 by POU, NEPED

12. Models Of Agro-Forestry
    Published 2003 by POU, NEPED

13. Package Of Practices On Black Pepper
    Published 2003 by POU, NEPED

14. Cultivation Of Large Cardamom
    Published 2003 by POU, NEPED

15. Package Of Practices On Ginger Cultivation
    Published 2003 POU, NEPED

16. Integrated Management On Cash Crops
    Published 2003 by POU, NEPED

17. Kiwi Fruit Cultivation
    Published 2003 by POU, NEPED

18. Passion Fruit Farming
    Published 2003 by POU, NEPED

19. Strengthening Market Linkages for Women Vegetable Vendors
    Published 2004 by Vengota Nakro & Chozhule Kikhi, POU, NEPED

20. Shifting Cultivation practices of Konyak People of Mon District of Nagaland: The Characteristics That Make It Sustainable and Productive.
    Published 2004 by Vengota Nakro, POU, NEPED

21. Dynamics Of Micro Credit In Tribal Society
    Published 2005 by POU, NEPED

22. Consolidated Trip Reports (A NEPED Experience
    Compiled 2005 by Vizonyu

III. Online Publications

1. A self Assessment Using Outcome Mapping- www.idrc.ca/ www.icefindia.org
2. Promoting Sustainable Agro-forestry in Nagaland- www.idrc.ca
3. Applying Lessons in Evaluation- https://idl-bnc.idrc.ca
4. Integrating Social and Gender Analysis into Natural Resource Management- www.crdi.ca
5. Traditional Market and Urban Planning: A case Study- mail.sarai.net
6. Learning Workshop on Participatory Approaches- idrinfo.idrc.ca
7. Outcome Mapping in Nagaland- www.idrc.ca

ANNEXURE-2

ESTIMATION OF MAXIMUM POPULATION DENSITY ON JHUM SYSTEM OF NAGALAND[2]

Several workers have postulated formulae for computing carrying capacity of land under shifting cultivation, prominent among others are; Allan's (1949, as quoted by Fearnside, 1986) formula was to compute area of land required per head, Conklin's (1959, as quoted by Fearnside, 1986) formula was to estimate critical population size and critical population density, Carneiro's (1960, as quoted by Fearnside, 1986) formula referred to the population of the community that can be supported permanently in one locale, Gourou's (1966, as quoted by Fearnside, 1986) formula was for estimation of potential population density and Fearnside's (1972, as quoted by Fearnside, 1986) formula was for determining hectares per person at carrying capacity and Weidelt's (1968) formula was to estimate the maximum population density per km². Weidelt's formula takes into account the main parameters of shifting cultivation and therefore, is the most suitable one for computing maximum population density of land under jhum in Nagaland.

The assumptions in estimating the carrying capacity of the jhum system are that:

1. the total area under jhum cultivation remains constant at 632,000 ha,
2. the population growth rate remains at 3.5% per year,
3. there is no emigration taking place en masse, and
4. immediate changes in the livelihood system is not taking place by abandoning jhum system

Table 1: The present carrying capacity of land in districts mainly with jhum cultivation

Districts with mainly jhum cultivation	Average cropping period (a) in years	Average fallow period (b) in years	Per caput cultivated area (c) (ha)	Area not suitable for jhum (e) (%)	Carrying capacity (D) (pers/km²)
1	2	3	4	5	6
Zunheboto	2	6	0.28	14	77
Wokha	2	4	0.37	16	76
Mokokchung	2	8	0.19	17	88
Tuensang	2	6	0.31	11	72
Mon	2	6	0.22	11	101
Average	2	6	0.27	14	80

$$D = \frac{100 - e}{\left(\frac{b}{a} + 1\right) c} = \text{pers/km}^2$$

[2] Vengota Nakro 2001. Adjustment of the jhum system in Nagaland to increased population pressure (Thesis to obtain M.Sc. Tropical forestry, Goetingen University, Germany)

where,

D = population density per km²
a = average cropping period in years
b = average fallow period in years
c = average cultivated area per head in hectare
e = percentage of land not suitable for agriculture (infrastructure, rocky, steep or swampy ground, etc)

Assumption:

The maximum population density 'D' refers to only those who are depending on jhum cultivation for livelihood.

Table 2: Increasing the carrying capacity by improving the main parameters of the jhum system

System number	Jhum systems	Cropping period 'a' (years)	Fallow period 'b' (years)	Per caput area 'c' (ha)	Area not available for jhum 'e' (ha)	Carrying capacity *'D'* (pers/km²)
1	2	3	4	5	6	7
1	Sustainable system without improvement	2	15	0.30	30	27
2	Current practice in Nagaland	2	6	0.27	14	80
3	Extension of cropping period by rotational cropping: SARS Model	4	5	0.27	14	142

ANNEXURE-3

A Brief History of NEPED

NEPED is people centric project to induce improvements of jhum and judicious use of natural resources. The project is being implemented in phase wise. The first two phases of NEPED project was an India Canada Environment Facility (ICEF) – Government of Nagaland funded project. The first phase started in February 1995 and ended in March 2001, where IDRC, Delhi monitored the project. The second phase-commenced operations from April 2001 and completed on 31st June 2006. The third phase is being funded by the Government of India under Watershed Development Programme in Shifting Cultivation Areas (WDPSCA), Ministry of Agriculture and had begun the implementation in 2006 for a period of 5 years.

The project is being implemented by a team of government officers drawn from various government departments and is called the Project Operations Unit (POU). A Team Leader who is also a Secretary to the Government of Nagaland heads the POU.

The goal is of the project is Environment Protection and Economic Development.

In the first phase 1995-2000 undertook a programme for planting trees along with Jhum cultivation practiced by the tribes of Nagaland.

The second phase (2001 – 2006) of the programme is to sustain the trees so planted by providing alternative means of livelihood and income to the farmers. NEPED-II is centred on creating a Micro Credit Mechanism in the villages, through which a paradigm shift from subsidy oriented mindset of the people towards self-reliance is created.

FIRST PHASE: Nagaland Environment Protection through Economic Development (NEPED)

In the first phase, the premise was two-fold:

- Acceptance of the fact, that Jhum cannot be stopped or eradicated completely.
- Jhum could be made sustainable if measures are taken to address food security by way of enabling farmers to earn income.

The strategy was simple and straightforward. Since the jhum farmer was already planting a diverse portfolio of *annual* crops, why not ask them plant another *perennial* crop – trees.

Some salient features of this phase are:

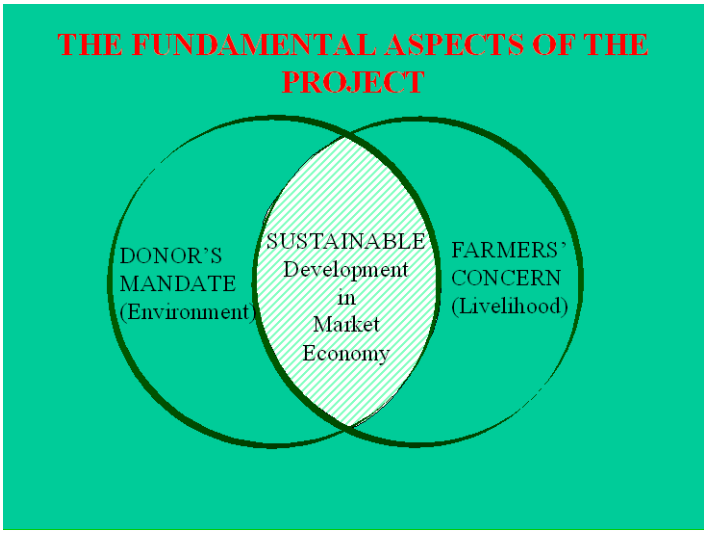
- NEPED was Nagaland's first external donor funded project with Rs. 12.86 crores allocated over the 5-year period from ICEF and implemented by International Development Research Centre (IDRC), Delhi
- 1794 farmers' *Test Plots* (and not *demo plots*) were established in 854 villages (out of 1010 villages) all over Nagaland, covering about 5500 hectares of land. Over 7 million trees were planted in the first phase.
- Survey conducted by an external evaluator in 1999 has recorded that replication of the NEPED intervention was at a ratio of 1:6 (about 33,000 ha.). This figure is likely to be much higher now.
- The Government of Nagaland declared 1999 as "The year of tree plantation" and about Rs.2.5 crores was spent in plantation of indigenous species all over Nagaland, an activity closely coordinated by NEPED staff and the district administration.

- As a result of concerted sensitization exercise in the villages and also the empowerment and leadership training imparted to 213 women from 123 villages, the village councils allotted 93 test plots to women.

SECOND PHASE: Nagaland Empowerment of People through Economic Development (NEPED)

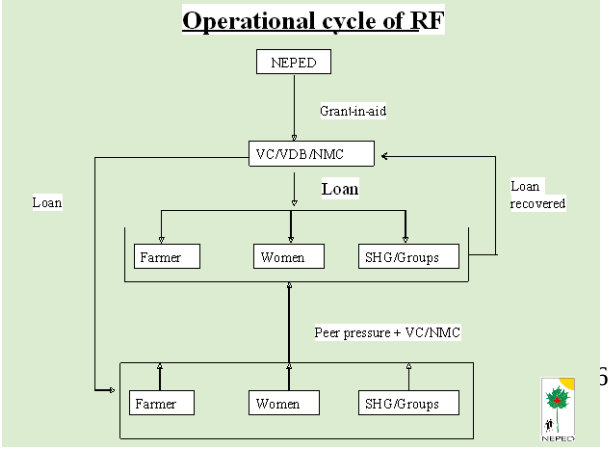
This phase started its operation in April 2001 and completed in 2006. Normally ICEF do not fund the second phase of any project but NEPED was an exception because its high level of performance during Phase-I. The second phase is focused on 105 villages equitably spread across all districts of the state. The project strategy is to empower the Village Councils (VCs) and Village Development Boards (VDBs) as the mechanism of delivery. NEPED capacitated these institutions for village level interventions, instead of merely using them as entry points into local communities.

The approach has been totally decentralized to a participatory approach and villagers were consulted at every step. Farmers were encouraged to plant shade-tolerant cash crops in their plantations, after extensive research on the market demands and the agro-climatic suitability for various biome zones in Nagaland. Some of these crops are cardamom, ginger, black pepper, betel vine and passion fruit.



The rationale behind selection of shade tolerant cash was to merge the donor's mandate and to address the concern of the farmers in rural cash poor villages. The donor's mandate was to protect environment and the farmers concern was livelihoods. The project was of the opinion that both the mandate and the concern could be addressed when farmers cultivate cash crops that had demand in the market, shade tolerant and could be grown underneath growing trees, preferably perennial in nature and are high value, low volume having long shelf live.

It was also the objective of the project that the farmers become transparent, accountable to the fund received by them at the same permanent assets are created that generates income for the household. Towards this end the project introduced Revolving Fund to the project villages wherein NEPED gave grant-in-aid to the village council who in turn gave loan to the individual farmers on loan. The loans that were recovered form the loanees were collected by the village council which were ploughed back to needy farmers who were in 'wait list'. This was the fund that was given to the village grew in size and loans are available at the door step of the farmers. The mode of operation can be seen at Figure below.



Out of the Rs. 12.85 crores total fund available over 5 years, Rs. 8.26 crores was directly transferred to the bank accounts of 105 participating villages for setting up the revolving credit mechanism. 25% of this fund (Rs. 2.25 crores) is exclusively earmarked for women to take up schemes and programmes of their own. The VCs/VDBs in turn has loaned out this amount to about 11 000

farmers for taking up income generating agro forestry activities using shade loving cash crops like Cardamom, Passion Fruit, Ginger, Turmeric, Black Pepper, Arecanut and Tea.

Farmers are being encouraged to establish SHGs (Self Help Groups) and marketing boards, bringing about social cohesion and a business mindset. The programme has turned out to be extremely successful. The need however, now is appropriate technology to be provided to the farmers to add value to their production.

OTHER SUB-PROJECTS:

- The research activities of the first phase on jhum-related interventions continue being fine-tuned. This is being done through a much smaller parallel 3-year project funded by International Development Research Centre (IDRC).
- The Ministry of Environment and Forests (MoEF), Government of India has approved a project for NEPED to set up a center for *in situ* preservation of endangered and endemic plant species. This center is located at Merema Integrated Model Plot.

THIRD PHASE: Nagaland Empowerment of People through Economic Development (NEPED)

Drawing from the experiences and learnings form the last two phases of NEPED project implementation the third phase of the project begun its operation in 2006 focused in 63 villages across Nagaland in 11 districts. The total budget outlay is Rs.15.82 crores for a period of five year.

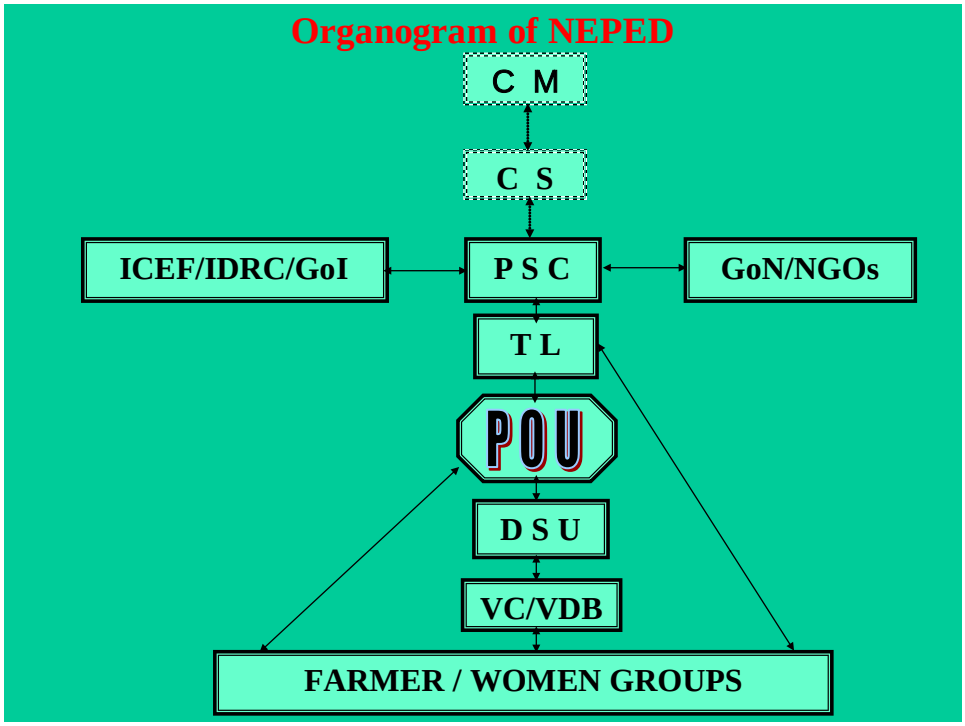
The main activities of this phase are as follows

- Afforestation in current jhum with emphasis on encouraging natural regeneration of trees in the farmers' fields
- Plantation of fruit trees and cash crops that have high demands in the market
- Improving the livelihoods of the farming family through household activities such as backyard piggery, poultry, goat rearing and bee-keeping at tributing to landscape improvements
- Sedentarisation of agriculture through increased area of homestead gardens for production of surplus vegetable for sale in the market and permanent terraced rice cultivation (TRC)
- Introducing improved soil and water conservation measures in the jhum fields

OTHER SUB-PROJECTS

- Off-station research finding are easily translated to other farmers on jhum-related interventions. This is being done through a much smaller parallel project funded by International Development Research Centre (IDRC).
- Community biodiversity conserved areas is becoming a widespread movement in Nagaland. In order to provide technical support and linkages, Sir Dorabji Tata Trust had initiated a programme 'Strengthening community conservation efforts Nagaland' with an outlay of Rs.2.65 crores for a period of three years

Organisational Structure of NEPED



C M: Chief Minister of Nagaland in the Minister in charge of the NEPED

C S: Chief Secretary is the Chairman of the Project Steering Committee

PSC: Project Steering Committee provides policy guidance to NEPED. The members of PSC are:

Representatives from: India Canada Environment Facility (ICEF), International Development Research Centre (IDRC), Government of India (GoI; Ministry of Environment and Forest and Ministry of Agriculture), Government of Nagaland (GoN: Head of Departments of Agriculture and Allied Sector) and Non-Governmental Organisation (NGO: Naga Mothers' Association).

TL: Team Leader is a senior bureaucrat from Government of Nagaland. He heads the NEPED project

POU: Project Operations Unit members are multidisciplinary team. Presently there are 10 members drawn from different Government Departments whose services are placed full time into NEPED for a period of 5 years. The POU is the hub of NEPED

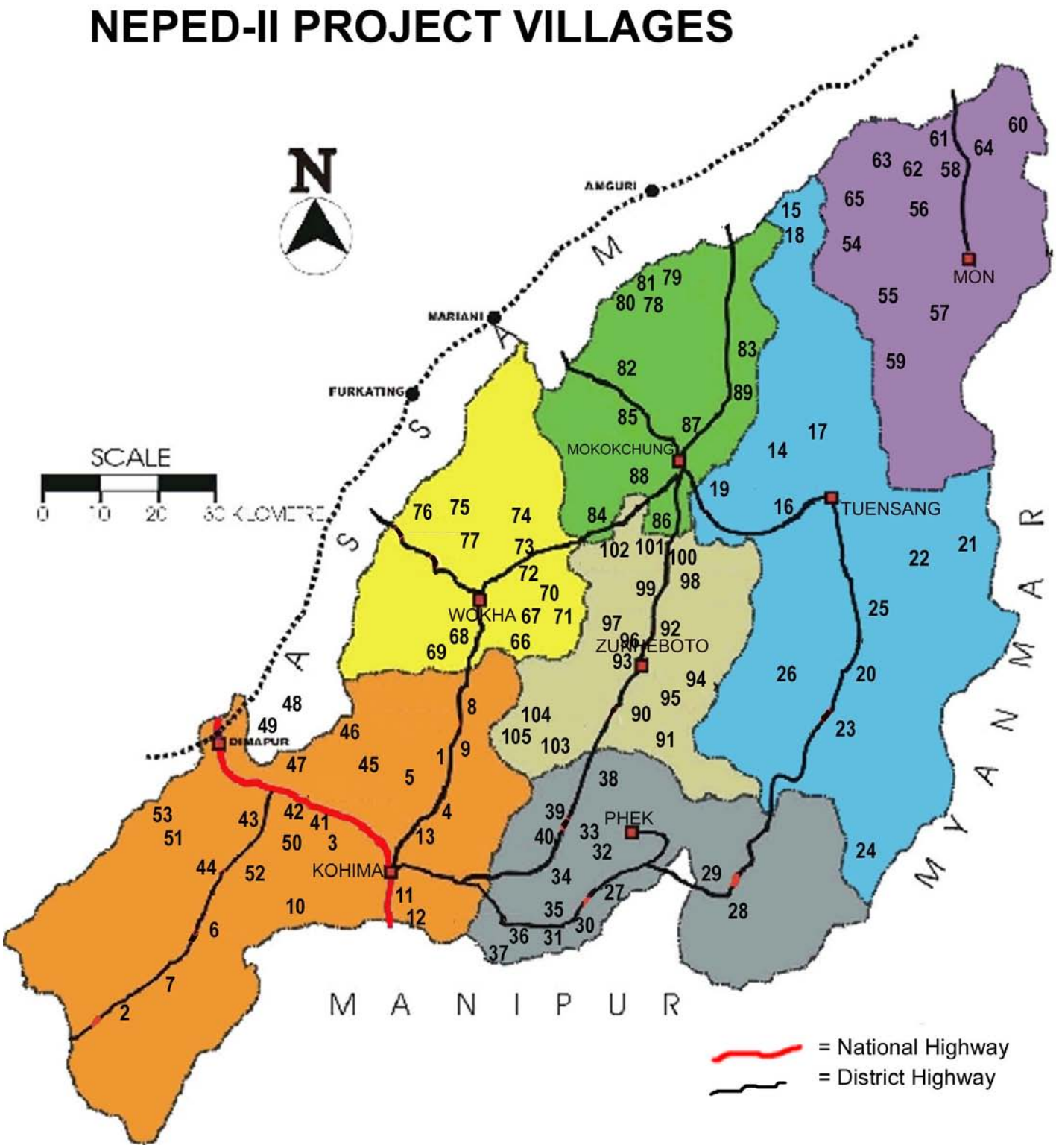
DSU: District Support Unit members are Officers selected from the District to monitor the project hand in hand with the POU members

VC: Village Council. The main village functionary at the village that served as the entry point for the project

VDB: Village Development Board. The development wing of the village council that implements the NEPED project on behalf of the Village Council

Farmer/ Women Groups: the beneficiaries of the project

ANNEXURE- 4


NEPED-II PROJECT VILLAGES
N
SCALE
0 10 20 30 KILOMETRE
ANGURI
MARIANI
FURKATING
MOKOKCHUNG
WOKHA
ZUNHEBOTO
TUENSANG
MON
PHEK
KOHIMA
DIMAPUR
ASSAM
MYANMAR
MANIPUR
= National Highway
= District Highway

NEPED-II PROJECT VILLAGES

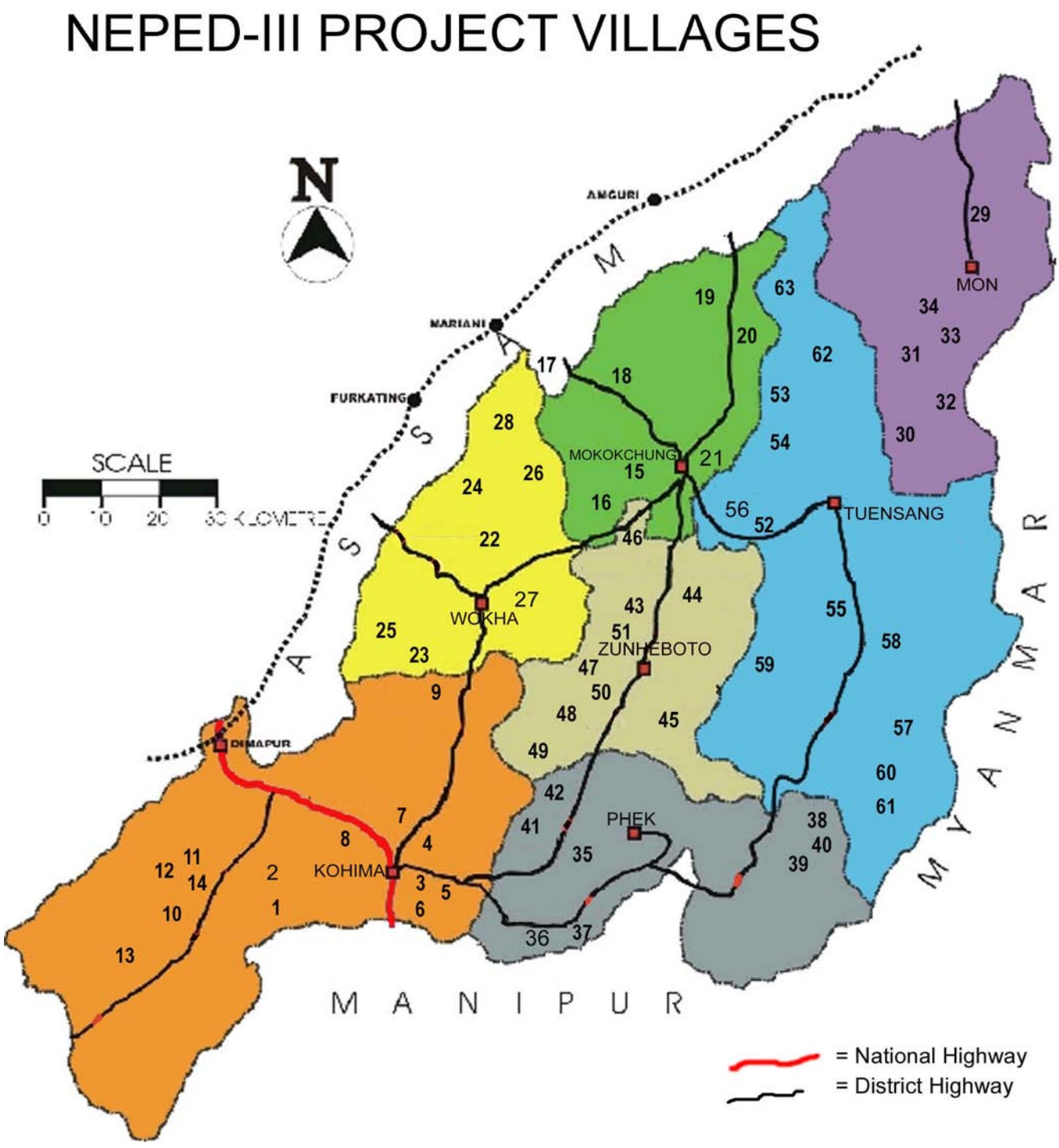
Sl. No.	District	Village
1	Kohima	Tsiese Basa
2	Kohima	New Tesen
3	Kohima	Peduca
4	Kohima	Nerhema
5	Kohima	Phekerukrie
6	Kohima	Gaili
7	Kohima	Peren Old
8	Kohima	Nsunyu
9	Kohima	Kontsunyu
10	Kohima	Khonoma
11	Kohima	Kigwema
12	Kohima	Viswema
13	Kohima	Kohima
14	Tuensang	Tuensang - P
15	Tuensang	Ngetchungching
16	Tuensang	Angangba
17	Tuensang	Hakchang
18	Tuensang	Shamnyuching
19	Tuensang	Chare
20	Tuensang	Leangkunger
21	Tuensang	Nokyan
22	Tuensang	Noklak
23	Tuensang	Singrep
24	Tuensang	Nitoi
25	Tuensang	Sangphur
26	Tuensang	Chomi-II
27	Phek	Losami
28	Phek	Khumiasu
29	Phek	Meluri
30	Phek	Chizami
31	Phek	Enhulumi
32	Phek	Sakraba
33	Phek	Pholami
34	Phek	Porba
35	Phek	Lekromi
36	Phek	Zapami
37	Phek	Khezhakeno
38	Phek	Yoruba
39	Phek	K. Basa
40	Phek	K.Bawe

Sl. No.	District	Village
41	Dimapur	Pherima
42	Dimapur	Medziphema
43	Dimapur	Chumukedima
44	Dimapur	Shoxuvi
45	Dimapur	Nihokhü
46	Dimapur	Nikhekhu
47	Dimapur	Vihokhu
48	Dimapur	Ghokito
49	Dimapur	Khekhokhu
50	Dimapur	Hekheshe
51	Dimapur	Urra
52	Dimapur	Rüzaphema
53	Dimapur	Bade
54	Mon	Kongan
55	Mon	Wanching
56	Mon	Goching
57	Mon	Ngangching
58	Mon	Tuimei
59	Mon	Mohung
60	Mon	Shangsa
61	Mon	Lapa
62	Mon	Oting
63	Mon	Lower Tiru
64	Mon	Ngangting
65	Mon	Upper Tiru
66	Wokha	Longsa
67	Wokha	Wokha
68	Wokha	Humtso
69	Wokha	Elumyo
70	Wokha	Koio
71	Wokha	Tsungiki
72	Wokha	Yikhum
73	Wokha	Riphyim-O
74	Wokha	Sunglup
75	Wokha	Soku
76	Wokha	Bhandari
77	Wokha	Sanis

Sl. No.	District	Village
78	Mokokchung	Changdang

79	Mokokchung	Aonokpu
80	Mokokchung	Chungtiayimsen
81	Mokokchung	Longphayimsen
82	Mokokchung	Dibuia
83	Mokokchung	Changtongya
84	Mokokchung	Longkhum
85	Mokokchung	Khar
86	Mokokchung	Longsa
87	Mokokchung	Sungratsu
88	Mokokchung	Ungma
89	Mokokchung	Chuchuyimlang
90	Zunheboto	Nikuto
91	Zunheboto	Ghukiye
92	Zunheboto	Lochomi
93	Zunheboto	Lizu Aviqhato
94	Zunheboto	Viyilho
95	Zunheboto	Viyixe
96	Zunheboto	Naghuto- O
97	Zunheboto	Naghuto-N
98	Zunheboto	Aotsakili
99	Zunheboto	Lokobomi
100	Zunheboto	Tichipami
101	Zunheboto	Sapotimi
102	Zunheboto	Izheto
103	Zunheboto	Phushulimi
104	Zunheboto	Natsumi
105	Zunheboto	Mishilimi

ANNEXURE- 5


NEPED-III PROJECT VILLAGES
N
SCALE
0 10 20 30 KILOMETRE
AMGURI
MARIANI
FURKATING
MOKOKCHUNG
WOKHA
ZUNHEBOTO
PHEK
KOHIMA
DIMAPUR
TUENSANG
MON
ASSAM
MYANMAR
MANIPUR
= National Highway
= District Highway

NEPED- III PROJECT VILLAGES

Sl. No.	Villages	Dist/Areas
1	DZüLEKEMA	KOHIMA - 9 Vils
2	THEKREJUNA	
3	MERIEMA	
4	TUOPHEMA	
5	MITELEPHE	
6	KEZOMA NEW	
7	KHONIBENZO	
8	SENDENYU NEW	
9	LOWESUNYU	
10	JALUKIE-B	PEREN - 5 Vils
11	MHAIKAM	
12	JALUKIE ZANGDI	
13	SONGLHUH	
14	NKWAREU	
15	KUPZA	MOKOKCHUNG - 7 Vils
16	MANGMETONG	
17	WATIYIM	
18	CHUNGLIYIMSEN	
19	LUYONG	
20	MERANGKONG	
21	CHUBAYIMKUM	
22	ENGLAN	WOKHA - 7 Vils
23	HANKU	
24	ALIKHUM	
25	CHANDALNSHUNG-O	
26	OKOTSO	
27	OKHYAN	
28	YIMPANG	
29	PHUKTONG	MON - 6 Vils
30	ANGCHAYANG	
31	CHAOHA CHINGLEN	
32	WANGTI	

Sl. No.	Villages	Dist/Areas
33	CHEN WETNYU	
34	YUCHING	
35	KETSAPO	PHEK - 8 Vils
36	KHONASU-M	
37	THETSUMI	
38	WUZU	
39	KEZATU	
40	SHATÜZA	
41	TURUTSUSWU	
42	SUTHOZU BASA	
43	LIZU NEW	ZUNHEBOTO - 9 Vils
44	PHUYE NEW	
45	LUKIKHE	
46	SUMI SETSU	
47	TUKUNASAMI	
48	GHATHASHI	
49	TUKULIQA	
50	KHUKIYE LUKHAI	
51	SUKOMI	
52	SANGSOMONG	TUENSANG - 8 Vils
53	LITEM	
54	YEMRUP	
55	KUTHUR	
56	CHIMONGER	
57	CHIPHUR	
58	YAKHAO	
59	CHESSORE	
60	LONGTSONGER	KIPHIRE - 2 Vils
61	PENKIM	
62	HUKPHANG	LONGLENG - 2 Vils
63	KANCHING	